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# **Exploring How Can Usability Taxonomy Inform Download Popularity of Socially Focused Wellness Smartphone Applications**

**By  
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**A Dissertation Submitted in Partial Fulfilment of  
the Requirements for the Degree of**

**Master of Information Systems**



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## *DECLARATION*

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## *ABSTRACT*

The research explored the way in which usability taxonomy can inform download popularity of socially focused wellness smartphone applications, in particular weight loss and diet apps. The aim was to investigate the Australian smartphone stores (iTunes and Google Play) in order to examine the efficacy of most popular wellness apps.

Reviewing the literature revealed that the rates of overweight and obesity have been increasing in Australia in the last two decades (ABS 2013; and National Health and Medical Research Council 2014). One of the most important strategies to manage this issue is self-monitoring. Some of the traditional widely used self-monitoring techniques include food diaries and regular self-weighing (Yeager et al. 2014). Nowadays, wellness smartphone applications play a significant role in monitoring and managing individuals' weights (Connelly 2006). According to Choi and Stvilia (2014), although smartphone applications markets (iTunes, and Google Play) list thousands of health smartphone applications, it is not always clear whether those applications are supported in credible sources. Likewise, Azar et al. (2013) points out that despite the prevailing use of smartphone apps to aid with weight management, the usability features of these applications are not well characterised. Thus, this field needs ongoing research to give users reliable information on the efficacy of the most popular apps for managing weight. Furthermore, given the fast development of technologies and applications, such studies are always valuable.

The methodology for this research utilised a subjective ontology, interpretive epistemology supported a qualitative method. The design of this research included three main stages: stage one - Identifying Apps; stage two - Development of Weight Loss and Diet Evaluation Framework; and stage three - Application of The Evaluation Framework. Each stage included specific tools and techniques: the first stage involved a selective review of the Australian iTunes and Google Play apps based on specific inclusion criteria; in the second stage, a content analysis assisted in utilising the existing theories of evaluation frameworks to develop the suitable weight loss and diet smartphone apps evaluation framework; and the third stage included practical application of the evaluation framework on the identified apps.

The data of this study was analysed by a qualitative content analysis, which was applied to the data of stage two - Development of Weight Loss and Diet Evaluation Framework. Descriptive statistics were utilised to analyse the data resulted from stage three- Application of the Evaluation Framework. Deductive thematic analysis was also used to analyse the apps users reviews.

This research has resulted in one main outcome, which was the development of a justified weight loss and diet smartphone apps evaluation framework. In addition, it has resulted in three key findings:

- **KF 1:** Applying the evaluation framework to the identified apps has shown that the most downloaded iTunes and Google Play apps are not necessarily the most usable and effective apps.
- **KF 2:** The search algorithms for the iTunes and Google Play is biased towards apps title keywords that do not accurately define the real functionality of the app.
- **KF 3:** Analysing the apps user reviews has supported the identified evaluation elements of the developed evaluation framework. In addition, it has shown that *Ease of Use, Reminder, Bar Code Scanning, Motivation, Usable for All, and Synchronisation* are significant attributes that should be included in weight loss and diet smartphone apps and thus in the potential weight loss and diet evaluation frameworks.

The research has contributed at the substantive level as it allowed showing the outcomes of evaluating the most popular weight loss and diet apps. At the methodological level, it combined different methodologies that formed an innovative method. At the theoretical level, it has identified the two main styles available in the literature to evaluate wellness smartphone apps and it has identified a literature based weight loss and diet evaluation elements.

This research has suggested several future research possibilities. Upcoming use of the evaluation framework would benefit from more than one single application. It suggested that the framework should be applied by more than one evaluator/iteration. The research has focused merely on evaluating iTunes' and Google Play's most popular apps. However, there is an opportunity for research to evaluate the most popular and unpopular apps to compare their results.



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[Holy Quran: Surah 11-Hud, verse 88].

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*“The best amongst you is the one who is best to his wife”.*

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*“When a human dies, his deeds come to an end except for three things: Sadaqah Jariyah (ceaseless charity), a knowledge which is beneficial, or a virtuous descendant who prays for him”*  
(Prophet Mohammad PBUH).

With love I dedicated this knowledge for my dad who passed away when I was 9 years old.

## *LIST OF ACRONYMS*

<b>WHO</b>	World Health Organization
<b>CDC</b>	Centers for Disease Control and Prevention
<b>BMI</b>	Body Mass Index
<b>DoH</b>	Department of Health
<b>ABS</b>	Australian Bureau of Statistics
<b>NHMRC</b>	National Health and Medical Research Council
<b>NHFA</b>	National Heart Foundation of Australia
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>HCP</b>	Health Care Providers
<b>IMS</b>	Institute for Healthcare Informatics
<b>ICT</b>	Information and Communication Technology
<b>OS</b>	Operating System
<b>PACMAD</b>	People At the Centre of Mobile Application Development

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# Chapter One

# Introduction

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## **1. INTRODUCTION**

This chapter provides an introduction to this thesis. The chapter is divided into the following sections:

- Section 1.1 demonstrates the background to the research and in particular three main relevant background domains: overweight and obesity overview; statistics of obesity in Australia; management of overweight and obesity.
- Section 1.2 defines the problem of the research, which includes: objectives of the research, question of the research, and overview of the approach adopted for this research.
- Section 1.3 presents a summary of the contribution of this thesis.
- Section 1.4 provides a summary of the limitations of this research.
- Section 1.5 demonstrates a review of the thesis structure, outlining the remaining chapters.

### **1.1 BACKGROUND**

This section provides an overview of the background that led to the undertaking of this research.

#### **1.1.1 Overview of Overweight and Obesity**

The World Health Organization (WHO 2014) defines overweight and obesity as abnormal or excessive fat accumulation, which may result in harming person's health. The Centers for Disease Control and Prevention (CDC 2012) refer to it as labels that are used to describe ranges of weight that are considered greater than the normal healthy weight for a given height.

The Body Mass Index (BMI) is utilised to determine whether a person is normal, overweight or obese. The BMI is measured by dividing a person's weight in kilograms by their height in meters squared (Commonwealth of Australia, Department of Health (DoH) 2009). While a person with BMI between 18.50 and 24.99 would fall into the normal range, a person is considered overweight at a BMI of 25 or more, and obese at a BMI of 30 or more (DoH 2009). The BMI is widely adopted for use internationally and by the WHO, who uses it to classify individuals into categories to measure associations

between chronic disease and mortality (DoH 2009). The table below shows classification of adults according to their BMI:

**Table 1.1: Classification of adults according to the BMI, adopted from: (DoH 2009).**

Classification	BMI	Risk of co-morbidities
Underweight	< 18.50	Low (but risk of other clinical problems increased)
Normal range	18.50 - 24.99	Average
Overweight	>25.00	
Pre-obese	25.00 - 29.99	Increased
Obese Class 1	30.00 - 34.99	Moderate
Obese Class 2	35.00 - 39.99	Severe
Obese Class 3	>40.00	Very severe

The primary cause of overweight and obesity, apart from genetic factors, is the energy imbalance where energy intakes (calories consumed) greatly exceed energy expenditure (calories expended) (DoH 2009; WHO 2014). Generally, the energy imbalance is due primarily to changes in the modern lifestyle environment such as changes in the means of transportation, diet, and physical activity patterns. Therefore, a balanced diet and sufficient levels of physical activity may prevent future weight gain. Being overweight or obese increases the probability of developing health related risks (Australian Bureau of Statistics (ABS) 2012). There are many health problems that occur as a consequence of obesity, including musculoskeletal disorders, cardiovascular disease, sleep apnoea, type 2 diabetes, and hypertension. Many of these diseases are preventable if a person's follows a healthy and active lifestyle (DoH 2009; WHO 2014). Table 1.2 summarises the different types of diseases related to overweight/obesity:

**Table 1.2: Diseases Associated with Obesity (adopted from: DoH 2009).**

Relative risk	Associated with metabolic consequences	Associated with weight
<b>Greatly Increased</b>	Type 2 diabetes Gall bladder disease Hypertension Dyslipidaemia Insulin resistance Atherosclerosis	Sleep apnoea Breathlessness Asthma Social isolation/depression Daytime sleepiness/fatigue
<b>Moderately Increased</b>	Coronary heart disease Stroke Gout/hyperuricaemia	Osteoarthritis Respiratory disease Hernia Psychological problems
<b>Slightly Increased</b>	Cancer (breast, endometrial, colon) Reproductive abnormalities Impaired fertility Polycystic ovaries Skin complication Cataract	Varicose veins Musculo-skeletal problems Bad back Stress incontinence Oedema/cellulitis

### **1.1.2 Statistics of Obesity in Australia**

Among Australian adults, the rates of overweight and obesity have almost doubled over the last two decades (ABS 2013; National Health and Medical Research Council (NHMRC) 2014). According to the DoH (2009), the Australian population is now ranked as one of the fattest amongst developed countries. In 2011-2012, more than 60% of Australian adults were classified either overweight or obese, and more than one quarter of the Australian adults fell under the obese category (ABS 2012; NHMRC 2014). Since 1995 the rates of overweight/obesity has increased in Australia from 56% to 61% (ABS 2012). While nearly 25% of Australian children aged 2-16 were classified as either overweight or obese in 2007, 6% of them fell under the obese category (NHMRC 2014). In terms of gender, the rates of overweight/obesity in 2011-2012 for males were significantly higher than females (ABS 2013). According to the National Heart Foundation of Australia (NHFA) (2012), in 2011-2012, while there were three million overweight males, or 42% of all men, nearly two million Australian females were overweight, or approximately 28% of all women. At the same time, obesity rates are quite similar across the two gender groups. Around two million Australian males and two million Australian females were obese, which is equivalent to 28% of all males and females (NHFA 2012).

The Organisation for Economic Co-operation and Development (OECD) predicts that the proportion of overweight/obese individuals across all age groups will increase in the next decade to about 66% of the Australian population (quoted in NHMRC 2014).

### **1.1.3 Management of Overweight and Obesity**

There are many strategies that may be implemented to manage this issue. One of the most important strategies is the behavioural interventional strategy for weight management and lifestyle changes, which require self-monitoring (Yeager et al. 2014). Self-monitoring increases self-awareness in regards to target behaviour and outcomes in relation to food intake goals. Self-monitoring can act as an early alarm system to indicate whether a risk of becoming overweight is increasing. Thus, the main goal of behavioural intervention is to promote lifestyle changes that not only lead to weight loss but also prevent weight gain or weight regain and encourage physical activities. Some

of the widely used self-monitoring techniques include food diaries and regular self-weighing (Yeager et al. 2014).

Smartphone applications can play an important role in monitoring and managing individuals' weight (Connelly 2006). Wellness technologies and wellness applications can monitor users' health and help them maintain a healthy lifestyle. Mobile technology and its applications allow people to monitor their weight more accurately than paper-based food or exercise diaries (Connelly 2006) (see Chapter 2, section 2.2.3.2).

## 1.2 THE RESEARCH PROBLEM

This section highlights the research objectives, question and its undertaking approach.

### 1.2.1 Research Objectives

The aim of this study is to investigate the Australian smartphone stores (iTunes and Google Play) in order to examine the efficacy of health wellness apps, particularly in the arena of diet and weight loss, because reviewing the literature reveals that the rates of overweight and obesity have increased in Australia in the last two decades (ABS 2013; and National Health and Medical Research Council 2014). Smartphone applications play an important role in monitoring and managing individuals' weight (Connelly 2006). Although mobile applications markets (iTunes and Google Play) list hundreds of thousands of health applications, it is not always clear whether those applications are supported by credible sources (Choi and Stvilia 2014). Azar et al. (2013) point out that despite the prevailing use of smartphone apps to aid with weight management; the usability features of these applications are not well characterised. Thus, this study aims to add to this field to give users insight into the most suitable apps for managing weight. Such studies are always valuable, given the fast development of technologies and applications. This research aims to achieve the following objectives:

1. Identify the most popular weight loss, and diet apps according to specific criteria.
  - Develop an understanding of Australian weight management apps.
2. Build a framework for evaluating the identified apps and apply this evaluation framework to the applications.

3. Compare the outcomes of the developed evaluation framework to specific metrics for justification.

### 1.2.2 Research Question

In order to meet the aforementioned objectives, the following research question has been developed:

**How can a usability framework inform download popularity of socially focused wellness smartphone applications?**

### 1.2.3 Research Approach

The methodology for this research utilises a subjective ontology, interpretive epistemology supporting a qualitative method. A review of the literature of evaluation wellness monitoring services has shown that answering the research question may be problematic. Thus, the research strategy is a phased approach: the researcher first has to understand the current available evaluation methods for wellness monitoring services, with a particular insight to evaluation of weight loss/diet services, and then find the answer to the research question. A content analysis is an important strategy that has been utilised in this research. The qualitative content analysis enables the researcher to build the proposed evaluation framework by critically analysing the literature of evaluation wellness monitoring services.

The design of this research includes three main stages: Stage One - **Identifying Apps**; Stage two - **Development of weight loss/diet Evaluation Framework**; and Stage three - **Application of the evaluation framework**.

Each stage includes specific tools and techniques: the first stage utilises a selective review of Australian iTunes and Google Play apps based on specific inclusion criteria; in the second stage, a content analysis assists in utilising the existing theories of evaluation frameworks to develop the suitable framework; and the third stage includes practical application of the evaluation framework and thematic analysis of user reviews.

The data of this study is analysed by content analysis, which is applied to the data of stage two - **Development of weight loss and diet Evaluation Framework**. Descriptive statistics are utilised to analyse the data resulted from stage three- **Application of the evaluation framework**. Deductive thematic analysis is used to analyse the apps users reviews.

## 1.3 RESEARCH CONTRIBUTION

This research has contributed to three levels of knowledge: substantive, methodological, and theoretical level:

### 1.3.1 Substantive Level

At the substantive level the thesis evaluates weight loss and diet smartphone apps, thus providing an opportunity to show the outcomes of the evaluations of weight loss and diet apps from the Australian iTunes and Google Play markets (see Chapter 6). Downloading apps and evaluating them, using the developed evaluation framework, shows that the popularity of apps does not always indicate the usability and effectiveness of an app.

### 1.3.2 Methodological Level

At a methodological level, this research provides a contribution as it combines multiple data collection and data analysis techniques that form an innovative approach to overcome the methodological limitations that result from a single method. The weight loss and diet evaluation framework has been developed using a content analysis of the literature. In addition, this research has applied the evaluation framework on iTunes and Google Play apps and then combined the outcomes that resulted from stage three - **application of evaluation framework** with a thematic analysis of apps users' reviews. The thematic analysis of users' reviews provides additional insight to the outcomes that resulted from applying evaluation framework to iTunes and Google Play apps and it emphasises the usability elements of the evaluation framework.

### 1.3.3 Theoretical Level

Finally, this research contributes at the theoretical level. The thesis identifies that there are two main styles in the literature to evaluate wellness smartphone apps (see section 2.4). This research supports the apps evaluation approach advocated by Breton et al. (2011). In addition, this research identifies evaluation elements based on several approaches in the literature (see section 5) that are suitable for evaluating weight loss and diet apps. Furthermore, this thesis contributes to improving the understanding of applying the smartphone evaluation framework on iTunes and Google Play apps.

## **1.4 SUMMARY OF THE RESEARCH LIMITATIONS**

This section considers the limitations of this research and presents tactics used to address some of the limitations.

### **1.4.1 Scope Of Research**

The research was of an exploratory nature and its scope aimed to provide insight on how a usability framework can inform the download popularity of socially focused health wellness mobile applications, in particular weight loss and diet apps. However, the research has focused only on those apps related to weight loss and diet which were identified according to specific inclusion criteria and hence the developed evaluation framework is not applicable to all types of apps.

### **1.4.2 Researcher Bias**

The subjective nature of qualitative research makes it vulnerable to bias from the researcher (Denzin and Lincoln 2005). The research has included multiple data collection and analysis techniques to reduce the influences of bias on this research.

### **1.4.3 Number Of Apps And Reviews Included In The Analysis**

As qualitative research requires more time for collecting research data compared to quantitative research (Johnson and Onwuegbuzie 2004; Anderson, 2010), the short time frame (6 months) for this study, caused the researcher to reduce the number of apps that were included in the analysis. This resulted in many apps without user reviews, which led to not fully saturated thematic categories and many repeated thematic categories (such as App Cons).

## **1.5 OVERVIEW OF THE THESIS**

This section provides a brief overview of the main chapters of this research:

### **Chapter 2: Literature Review**

This chapter provides an overview of the literature related to this thesis. The chapter has three main sections. The first section provides an overview of wellness monitoring as it considers one of the main strategies to solve the issue of overweight and obesity. The second section demonstrates the role of information communication



technology in healthcare and the role of smartphone applications in healthcare in general and in weight management in particular. Section three presents a review of the available evaluation methods for smartphone apps and in particular weight management, loss, and diet apps.

### Chapter 3: Methodology

This chapter includes the methodological approach that was utilised in this research. To answer the research question, three main stages that included several data collection and analysis techniques were conducted. First stage was the manual identification of iTunes and Android apps based on specific inclusion criteria. Second stage was a development of the weight loss and diet evaluation framework, developed by utilising a content analysis of the literature. The third stage was a practical application of the evaluation framework and a thematic analysis of all apps users reviews to support the results of stage three.

### Chapter 4: Identifying Apps – Phase One

This chapter describes the selective review of the Australian iTunes store and the Australian Google Play market apps. This chapter is structured in two parts. The first part demonstrates the manual process of selective review of apps from the Australian iTunes store, based on specific inclusion criteria. The second part describes the manual procedure of selective review of apps from the Australian Google Play market. Data gathered in this stage - **Identifying Apps** is a pre-request for entering the data into stage three - **Application of the framework**.

### Chapter 5: Data Analysis, Discussion, and Interpretation of Development of Evaluation Framework – Phase Two

This chapter presents the developed evaluation framework. **Development of the Evaluation Framework** utilised a content analysis of the literature to identify the proper method of evaluating apps. The literature also was analysed to build a suitable evaluation framework and its elements that enabled the evaluation of the weight loss and diet apps.

### Chapter 6: Practical Application of Evaluation Framework, and Its Discussion –Phase Three

This chapter demonstrates the application of the developed evaluation framework on the identified iPhone and Android apps, and the discussion of that application. The identified iPhone and Android apps were downloaded and the evaluation framework was applied. Descriptive statistics was utilised to analyse the data collected.

### Chapter 7: Thematic Analysis of Users Reviews

This chapter presents the process of conducting a deductive thematic analysis for apps users reviews. Deductive Thematic Analysis was suitable as it assisted in the interpretation of identifiable themes and patterns, which related to the elements of the evaluation framework. In addition, it identified themes that hold no relation to the elements of evaluation framework and thus added additional insight and meaning to the apps ranking in the framework. The thematic analysis was conducted at the latent level.

### Chapter 8: Discussion of Findings

The thesis includes several Chapters demonstrates the outcomes of conducting the stages of the research. Chapter 4 involves the outcomes of conducting the stage one- **Identifying Apps**. Chapter 5 demonstrates the outcomes of stage two- **Development of Evaluation Framework**. Chapter 6 presents the outcomes of stage three- **Application Of Evaluation Framework**. Chapter 7 includes the deductive thematic analysis of apps user reviews. Therefore, as each of these Chapters partially answers the research question, Chapter 8 provides a synthesis of the outcomes and interpretations. Furthermore, it highlights the key findings that appropriately answer the question of the research.

### Chapter 9: Conclusion and Future Works

This final chapter concludes the thesis and provides a brief summary of the main outcomes. It presents the answers to the research question. The chapter then demonstrates the research contribution to IS discipline field. It concludes with presenting the research limitations and suggestions for future work.

## 1.6 CHAPTER REFLECTION

This chapter provided a background summary to this thesis. It presents the research question, objectives, and an overview of its approach. The chapter provides a summary of the contributions of the research. The chapter demonstrates a summary of the research limitations. The chapter ends by providing an overview of the structure of the thesis outlining the remaining chapter of this thesis.

The next chapter will show the literature review of this research.

# Chapter Two

# Literature Review

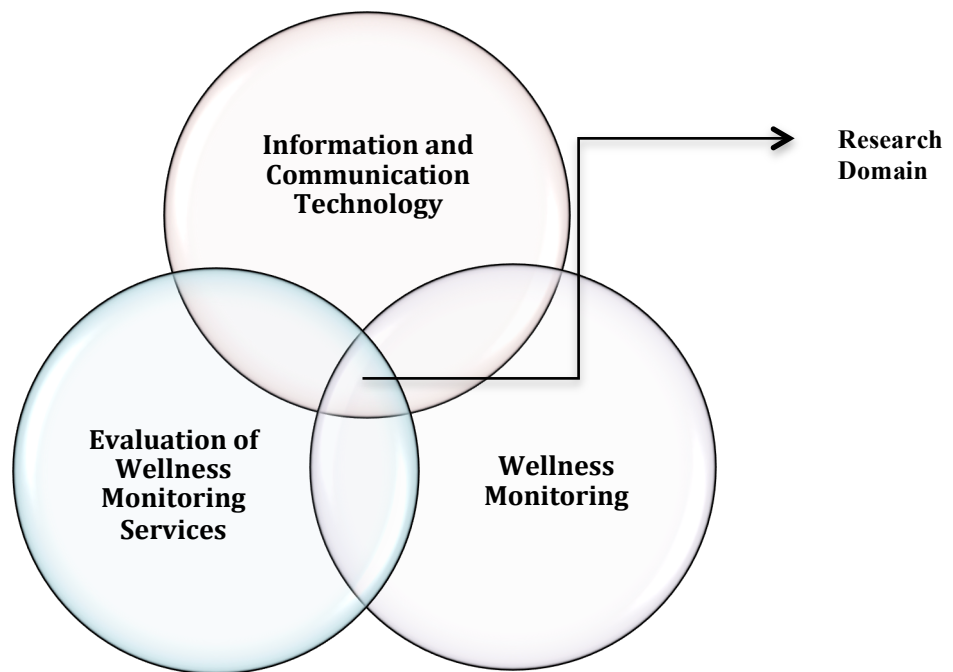
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## **2. LITERATURE REVIEW**

### **2.1 INTRODUCTION**

This chapter will review the literature pertaining to three areas, namely, wellness monitoring, information and communication technology, and evaluation of wellness monitoring services, with particular insight to weight management services. These three areas will be detailed in this research, as the research requires an understanding of these areas and the research domain consists of the intersection of these areas.

**Figure 2.1 The Research Domain**



This chapter is divided into the following sections:

- Section 2.2 provides an overview of wellness monitoring, as it is considered one of the main strategies to solve the issue of overweight and obesity.
- Section 2.3 demonstrates the role of information communication technology in healthcare, and the role of smartphone applications in healthcare in general and weight management in particular.
- Section 2.4 presents a review of the available evaluation methods for apps, and in particular weight management and monitoring apps.

## 2.2 WELLNESS MONITORING

### 2.2.1 What is Wellness Monitoring?

Aino et al (2008) defined “wellness” as a combination of emotional, mental, and physical aspects: the feeling that one is healthy, active, and energetic. They state that wellness involves three factors: physical activity, healthy diet, and good social relationships.

*Monitoring of wellness* refers to the observation of an individual aiming to identify variations in their health status (Safe Work Australia 2013). Dhillon, Lutteroth and Wünsche (2011) define health-monitoring services as a practice that helps their users to keep track of and visualise their health related factors. According to Biswas et al. (2010), monitoring and timely intervention are important in the continuing management of health among all segments of the population. The authors highlight that there is a growing awareness of continuous monitoring of health and wellness nowadays. Biswas et al. (2010) claim that the focus becomes the proactive management of wellness, rather than reactive management of illness. According to Hong et al. (2012), in recent years, monitoring of health is gaining more attention in both academia and industry as individuals become more aware of their everyday health conditions, and as mobile phones develop and become more capable than just for gaming and messaging.

There are numerous reasons for monitoring wellness. However, for the purpose of this study, the focus will be only on wellness monitoring services that aim to control weight, or reduce it. There are several methods that can be used for wellness monitoring, such as pen and paper, mechanical or electronic devices, or more sophisticated computerised diaries (Mattila 2010). Some of these methods are traditional and others are more innovative and are discussed in greater detailed in section 2.2.3.

### 2.2.2 What is Self-Monitoring?

Baker and Kirschenbaum (1993) define *self-monitoring* as

*“a systematic observation and recording of target behaviours”* Baker and Kirschenbaum (1993, p.377).

Yeager (2014) defines self-monitoring as the observing and recording of exercise and eating patterns, followed by feedback on those behaviours. Self-monitoring serves as an early warning system as it tries to detect problems and increase self-awareness of

target behaviours and consequences (Yeager 2014). Self-monitoring is where individuals utilise smart tools such as mobile apps or wearable sensors to collect, process, and visualise a huge amount of personal data, thus helping the individual monitor and manage personal health factors (Paddock 2013). Indeed, *healthcare providers* (HCP) can monitor individuals' health. However, according to Parkka et al. (2000), healthcare providers face clear issues in giving treatment and advice to people who are gaining weight or obese. The number of people who gain weight is more than the number of people who lose weight in western countries (Parkka et al 2000). They claim that more than 40% are either overweight or obese, about half of the population of Europe is in normal weight range, and less than 10% are underweight. Self-monitoring combined with guidelines provides an alternative for weight management (Parkka et al 2000). As Yeager (2014) has stated

*“one major and possibly most important behavioural interventional strategy for weight management and lifestyle change is self-monitoring”*  
(Yeager, 2014, p.1).

Hence, self-monitoring should be utilised to assist in solving the issue, and thus this study will focus on self-monitoring methods for weight management.

Parkka et al. (2000) indicate that there are many available Internet resources that aid individuals in personal management of health, although poor usability, issues with accessibility, security, and limited personalisation limit the use of these resources. However, the rapid development and merging of mobile communications, digital broadcasting, network infrastructure, and rich contents overcome many of these issues (Parkka et al 2000). Yeager (2014) claims that advancing technology is altering and improving self-monitoring techniques, breaking down some of the major barriers. The Internet is not the only self-monitoring method. There are many others ways for self-monitoring such as food diaries, regular self-weighing, exercise logs, and equipment (e.g. pedometer, accelerometers and metabolic devices) (Yeager 2014). The bottom line is that no matter what method, self-monitoring should be a main part of managing weight, weight-loss, or healthy lifestyle change (Yeager 2014). Self-monitoring sometimes is considered as the “cornerstone” and the most effective technique in behavioral management of obesity (Baker and Kirschenbaum 1993).

### **2.2.3 Methods For Wellness Monitoring**

There are traditional methods of wellness monitoring and more innovative ones. The following sections illustrate them.

#### **2.2.3.1 Traditional Wellness Monitoring Methods**

There are several traditional methods of wellness monitoring (Mattila 2010). Although the technology has been very accessible for everyone, at any time, many people still use traditional methods when they monitor their personal health (Connelly 2006). In nutrition sciences, a paper diary is considered a traditional monitoring method (Mattila 2010). However, Connelly (2006) argues that paper and pen diaries for managing eating or exercising are less accurate than mobile applications for wellness monitoring. The inaccuracy of the paper and pen diaries might result from the manual entering of user data. Besides, it does not include communal supports, despite the literature demonstrating that good social relationship contributes to building wellness (see section 2.2.1).

Another traditional way of monitoring individual health is carried out under the supervision of medical practitioner with experience in health monitoring (SWA 2013). Section 2.2.2 in this Chapter has previously pointed out to the role HCP in monitoring wellness. However, as the number of people who gain weight is more than the number of people who lose weight in western countries (Parkka et al 2000), HCPs faces an issue to give individual consultation for all obese people (see section 2.2.2).

Printed documents can also contribute to changing behaviours and habits (BinDhim, McGeechan, Trevena 2006). According to them, the most useful self-help method in smoking cessation program is printed documents. However, they claim that this method has disadvantages such as limited distribution, lack of interactivity, printing costs, and are limited in their ability to tailor for individual needs.

For the purpose of this study, the focus will be on the more innovative wellness monitoring methods namely smartphone wellness monitoring applications. The next section clarifies the effectiveness of the more innovative wellness monitoring methods that includes the wellness smartphone applications.



### **2.2.3.2 Innovative Wellness Monitoring Methods**

Nowadays, wellness technologies and wellness applications enable users to monitor their health, helping them to maintain a healthy lifestyle. Opportunities for consumers to access and engage in Internet and mobile-based health related information and services to support a healthy lifestyle is potentially broad (Andrews, Gajanayake, Sahama 2013). Wellness technologies are motivating individuals to increase the amount of physical activity and supporting weight management (Ahtinen 2008). According to Ahtinen (2008), the number of wellness technologies on the market has increased rapidly. *Wearable computing systems* benefit the wellness-monitoring area as they can unobtrusively collect physiological data and human annotations to monitor health and predict susceptibility to disease (Healey and Logan 2005). These wearable systems are useful for individuals who live independently and need tracking for changes in their health, such as elderly people and people who suffer chronic illness. They also allow users receive early warnings for health changes. Healey and Logan (2005) claim that such systems could improve quality of life for many people in countries with aging populations and reduce healthcare costs. As an example of wearable wellness system is the wearable watches that included sensors that able to monitor health attributes such as heart rate, weight, etc. According to Saviotti (2012), the sensors in these wearable medical devices enable monitoring vital signs and physiological parameters such as electrocardiogram (ECG), heart rate, body activity, blood pressure and weight to name a few.

Likewise, nowadays, there are many *Internet-based* health resources that aim for wellness monitoring, e.g. lifestyles websites that address issues such as smoking, lack of exercise and overeating. Rodger et al. (2013) demonstrated that 51% of participants in his study used babycenter.com.au for seeking healthy pregnancy information and advice. Also, calorieking.com website provides a food and exercise database linked to a user personnel diary and it converts meals and activities into calories, and thus the users can see if they are achieving weight-loss goals (Dubansky 2010). Dubansky (2010) states that the weekly progress charts and graphs in the website can motivate dieters. BinDhim, McGeechan, Trevena (2006) point out that computerised smoking cessation intervention is better than printed documents in that it eliminates cost of printing, makes updating easier, and can include interactivity and tailored intervention features.

However, renewing them requires users to download updates from the Internet, CD, or other computer media (BinDhim, McGeechan, Trevena 2006).

Smartphones in particular play an important role in monitoring and managing individuals' wellness. *Smartphone applications* can assist users in managing and monitoring health related activities. They also allow the providing of real-time feedback and can employ persuasive technology for both chronically ill and healthy individuals (Connelly 2006). Wellness monitoring applications are altering the concept of self-monitoring. Mobile technology and its applications allow people to monitor themselves more accurately than paper-based food or exercise diaries (Connelly 2006). According to Gilmore et al. (2014), Turner-McGrievy et al. conducted a behavioural weight loss experiment on obese adults, examining and comparing the use of weight monitoring apps and the traditional pen-and-paper method. The most popular apps used in this intervention were Fat Secret's Calorie Counter, MyFitnessPal, and Lose it!. The result of the study suggested that individuals who were using the apps lost more weight than those were under the traditional method. The concept of self-monitoring also changed by altering the isolated process of self-monitoring into a communal, supportive process where multiple individuals who have similar health interests can check the user's progress and give encouraging feedback (Connelly 2006).

The advantage of smartphone applications compared with computer based wellness-monitoring resources is becoming easily accessible with users. The widespread availability of tablets and smartphones and the accessibility to Internet everywhere has led to the use of apps in many aspects of life (IMS Institute for Healthcare Informatics (IMS) 2013). There are tens of thousands of health applications available at the online stores for downloads to Apple and Android devices. Most efforts in the healthcare apps development focused on wellness: specifically, apps that can be used by consumers to monitor their wellness, prevention or treatment regimens (IMS 2013). As examples of some popular apps that provide features that track diets as well as physical activities are MyFitnessPal, Lose it!, FatSecret's Calorie Counter and SparkPeople (Gilmore et al 2014). Connelly (2006) claims that developing such applications to empower both ill and healthy users gives an opportunity to assist the currently ill and reduce illness in the future with preventative applications.

Thus, information and communication technologies have demonstrated benefit of positively influencing wellness monitoring across a range of health issues. This study will focus on such technology to assist in managing the issues of obesity in Australia.

Section 2.3 will give a detailed description of the role of information and communication technology in monitoring wellness particularly monitoring individuals' weight.

### **2.3 INFORMATION AND COMMUNICATION TECHNOLOGY IN HEALTHCARE**

#### **2.3.1 Information and Communication Technology (ICT)**

The World Bank describes ICT as a set of activities facilitated through electronic methods for the processing, transmitting and display of information (United Nation (UN) 2003). ICT is also defined as a complex and diverse set of goods, applications and services involved in the production, distribution and the transformation of information via technologies such as telecoms, TV and radio broadcasting, hardware and software, computer services and electronic media (UN 2003; Perron et al. 2010). ICT could include *old* technological means such as radio, TV and telephone (UN 2003) as well as the *new* methods including e-mail, mobile messaging, video chats via Skype for example, and online social networking such as Facebook, YouTube and Twitter (Perron et al. 2010). The capacities of ICTs to instantaneously connect enormous networks of people and organisations across the globe at very low costs provide revolutionary new potentials (UNDP 2001). ICTs continue to play major roles in globalisation and assisting in the flow of information, capital, ideas, people and products around the world. ICTs have transformed the way businesses operate and have revolutionised learning and knowledge sharing means (UNDP 2001).

ICT includes all the different types of computer devices, including computers, laptops and smartphones (advanced mobile phones), which accomplish a broad range of communications services and information functions (Perron et al. 2010).

#### **2.3.2 Mobile Phone and Smartphones**

A mobile phone is a telephone that accesses a cellular radio system, which allows using it over a wide geographical area without the need for a wire (Oxford Dictionary

2010). Mobile phones have rapidly emerged as an ordinary device in societies across the world (Wells, Bailey & Link 2013). Over the last decade, mobile phones have been continually and rapidly changing and developing to add value to consumers. Tojib, Tsarenko & Sembada (2014) define a value-added mobile phone (*smartphone*) as a device that provides services beyond voice calls and SMS services that are offered by telecommunication companies. They describe a smartphone as a device that offers its users the opportunity to more than just communicate with other people; it provides pleasure, performs activities and transactions and it becomes a source for obtaining information and knowledge (Tojib, Tsarenko & Sembada, 2014). Sarwar and Soomro (2013) define a smartphone as a mobile phone that includes advanced features and functionality ahead of the traditional feature phone that is merely capable of making phone calls and sending text messages. Smartphones provide users with the capabilities to display photos, play games, video, or audio, includes the capability to navigate, record, take pictures, surf the web and much more. Mosa, Yoo and Sheets (2012), defined the smartphone as a new technology that integrates computing and mobile communication capabilities in a handheld-sized device.

According to Wells, Bailey & Link (2013) and Tojib, Tsarenko & Sembada (2014), the use of smartphone is expected to continue to grow quickly all over the world. Yet, the adoption rate of smartphone usage are still very low and remains far from reaching its full potential, since most nations have a below 50% penetration rate (Tojib, Tsarenko & Sembada 2014). Nonetheless, smartphone usage is experiencing fast growth in our daily lives (Fine & Menictas 2012). The integration of smartphone into our daily lives provides an opportunity across the board for consumers, marketers, and researchers. As the adoption of these smartphone continues to grow, utilising apps that monitor or manage weight by Australian people could contribute to individuals better managing the issue of overweight and obesity.

Smartphones are generally run by specially designed operating system (OS) platforms to facilitate computing and communication services. Smartphones' OS platforms are integrated with many standardised features and *applications* such as organisers, contact lists, e-mail, and web browsers. Smartphones' OS platforms are capable of running third-party software applications. The major smartphones' OS platforms are Palm OS, Windows Phone, BlackBerry, *iOS*, and *Android* (Mosa, Yoo and Sheets 2012).

### **2.3.3 Smartphones' Applications and Operating System (OS)**

A mobile application (commonly known as an app) is a software application designed to run on smartphones, tablet and other mobile devices. Apps are offered through application distribution platforms that are typically operated by the owner of the smartphone OS. For example, Apple manages the App Store (iTunes), which is an application store for iOS, Google offer Google Play, which is an application store for Android OS (IMS 2013). Apps found in both of these stores are expanding rapidly. According to Mosa, Yoo and Sheets (2012), while iTunes has more than 425,000 applications, Google Play has more than 352,800 apps as of 2011. However, although iTunes is currently leading in terms of the size of the store, Google Play is growing at a faster rate than iTunes (Mosa, Yoo and Sheets 2012). Currently, Apple's iOS and Google's Android are the main competitors in the smartphone market (Mosa, Yoo and Sheets 2012).

iOS was developed by Apple for their iPhone; the only Smartphone in the world that runs the iOS. In 2010-11, the iOS was ranked second, holding a market share of around 25% of the global smartphone industry (Mosa, Yoo and Sheets 2012).

Android is an open source operating system developed by Android before it was acquired by Google. Globally, the Android use is growing very quickly. Within fifteen months, Android market share increased significantly in the US by almost 30%, reaching 38% of the smartphone market and placing it in first position (Mosa, Yoo and Sheets 2012).

### **2.3.4 The Role of ICT and Mobile Phone in Consumers' Health and in Wellness Monitoring**

The rapid growths of ICTs and Internet accessibility have greatly influenced different aspects of life including social, political, economical, and health processes (Perron et al. 2010; Lewis et al. 2011). Perron et al. (2010) argues that despite the fact that ICTs continue to influence the work of social workers and their clients, ICTs have received inadequate attention in the literature and curriculum. They argue that social workers should respond to the technological changes in the healthcare system, which include clients' use of technology (Perron et al 2010). The World Health Organisation

sees ICTs as viable tools that contribute to health improvement. Ideally, ICT for health can be defined as electronic tools that facilitate the communication, processing or transmission of health information in order to improve individuals' health (Lewis et al. 2011).

ICTs play major roles in improving human health. ICTs offer efficient and effective tools for managing individuals and ideas, allow sharing knowledge, data and education and improve collaboration (Perron et al. 2010). Thus, such tools could be utilised in the health sector to improve health perceptions among individuals. Lewis et al. (2011) referred to ICT as a key driver in healthcare delivery and public health. An effective implementation of ICTs can improve accessibility for geographically isolated communities, support knowledge sharing and aid in data capture, storage, interpretation and management (OECD 2010).

Some of the potential benefits of effective implementation of ICTs in the health sectors include increasing efficiency and quality of care; reducing operating costs; reducing administrative costs; and facilitating new modes of care (OECD 2010). For example, ICTs play a key role in rural Western Australia where telemedicine can facilitate development of more integrated and comprehensive primary health services and overcome issues related to isolation and remoteness (OECD 2010).

Smartphones play major roles in different industries including the health sector. Due to the communication capabilities of smartphones, smartphones provide medical practitioners with communication features such as access to e-mail and allowing them to work with patient records. One example of the adoption of smartphones in the field is the electronic prescription by health provider (Park and Chen 2007). At the other end, smartphones' users are using their devices for accessing health related services. Thus, smartphones can facilitate communication in the health industry.

According to Sarwar and Soomro (2013), there are enormous numbers of smartphones apps that facilitate health services. For example, there are applications that manage and validate prescriptions and promote alternative medication. There are many apps today under the health and fitness categories that promote wellness and aim improve consumers' health such as ones that track exercise, diet and blood pressure. Therefore, smartphones today also play a major role in improving users' health (Sarwar and Soomro 2013).

### *ICT and Smartphones in Wellness Monitoring*

While technologies might be the main reasons for inactive behaviour in societies nowadays, it still plays a major role in people's wellness monitoring and health management. Technologies can intervene and improve individuals' health, and change people's health behaviour for the better. ICTs including SMS, websites and smartphones applications are all tools that play a novel role in health management such as effective weight management programs. These tools can significantly contribute to the success of such programs (Gilmore et al. 2014). There are a lot of benefits that can be obtained through the implementation of ICTs in health management. The use of ICTs in weight management programs can improve the overall weight management as well as improving the cost effectiveness. Quickly developing and innovative technologies should be employed to improve individuals' health (Gilmore et al 2014).

Smartphones play an important role in monitoring and managing individuals' wellness. Smartphones apps can assist users in monitoring health related activities. The availability of tablet computers and smartphones and the wide accessibility of the Internet led to the extensive use of apps in many aspects of life (IMS 2013). There are tens of thousands of healthcare applications available at the online stores for downloads to Apple and Android users. The foreseeable power of apps in the health industry is an important driver for innovation and creativity. According to the IMS, most efforts in the healthcare apps development focused on wellness. Specifically, on apps that can be used by consumers to monitor their wellness, prevention or treatment regimens (IMS 2013). Currently, there are more than 40,000 apps under the health and fitness category available for tablet and smartphone users (Sarwar and Soomro 2013). Also, there are more than 500 health applications under development worldwide (Sarwar and Soomro 2013). They argue that health apps' users who are participating in wellness program are obtaining the benefits of mobile's health even without realising it. Furthermore, the number of consumers using such apps is increasing dramatically reaching 247 million in 2012. Smartphones users can get the benefit of better wellness managing and monitoring in general (Sarwar and Soomro 2013).

According to the IMS (2013), there are more than 7,717 free healthcare applications available for download for Apple users. The largest two groups of apps under the health category are diet and fitness, where there are more than 5,400 apps aiming to provide users with calorie tracking, fitness routines, monitoring weight and



BMI. The main components of behavioural weight loss programs are self-monitoring of physical activity and dietary intakes. Therefore, the various apps intend to provide substantial support and guide the users to achieve their health goal and lower the burden of behaviour on overall healthcare costs (IMS 2013).

Thus, as the number of health apps and their consumers are increasing, good weight management apps should be utilised in assisting to overcome the issue of overweight and obesity.

### **2.3.5 Most Popular Weight Management and Monitoring Apps**

This section aims at identifying some of the most popular weight management and monitoring apps in the Apple and Android stores. To encourage utilisation of wellness apps and behavioural modification, many health care and fitness apps use self-monitoring (Gilmore et al. 2014). To illustrate, weight management programs use many strategies to incorporate self-monitoring, which can be done by tracking the type of foods that are consumed and their portion size. Weight management apps are characterised with different features: most of them include comprehensive databases of food; some even include barcode scanners that enable identification of calories contained in packaged products, and others allow adding manual entry of meals and estimating their calories (Gilmore et al. 2014). While the majority of apps in this group focus on calories' counting for weight loss, some apps provide physical activities and track exercising. MyFitnessPal, Lose it!, FatSecret's Calorie Counter and SparkPeople are just a few examples of the most popular apps that track diets and physical activities. Fooducate, on the other hand, is an application that focuses only on diets and recording intakes, which offers information related to nutrition and a substantial food database (Gilmore et al. 2014). All of these apps are available for download for both Apple and Android users.

Beside the apps developed to track food intake or promote positive health behaviour, there are some other wellness apps that focus on exercising and monitoring physical activities. Some of these apps employ self-monitoring strategies similar to the one used in diet tracking. MyFitnessPal, Lose it!, FatSecret's, Calorie Counter, and SparkPeople are among the most popular apps that track physical activity and exercise occurrences. The mechanisms of these apps are to count the calories burned from exercising based on numerous activities added in its databases and deduct it from the



daily calorie goal. In addition, there are some other apps such as Fitocracy and RunKeeper are solely for tracking the physical activities. RunKeeper, Endomondo, and Map-my-Run try to differentiate themselves from the majority of other training apps by including GPS capability, which allow for tracking route, distance, duration, and calories burned. Pedometer Free, Pedometer Ultimate, and Pedometer Step Counter are amongst the most popular freely available apps that use the GPS capabilities. Moreover, there are some wellness apps that guide the users throughout the exercise session. They can give step-by-step directions and aim to provide strength-training program. Fitness Buddy is one of the popular apps that deliver such a service (Gilmore et al. 2014).

Although mobile applications markets (iTunes, and Google Play) list hundreds of thousands of health mobile applications, it is not always clear whether those applications are supported by credible sources (Choi and Stvilia 2014). Likewise, despite the prevailing use of smartphone apps to aid with weight management, the usability features of these applications are not well characterized (Azar et al. 2013).

Thus, as there are a large number of apps related to weight management and diet in both stores (iTunes and Google Play), evaluating the usability of these apps is required so that users are able to make informed choices when engaging in wellness monitoring.

Section 2.4 will present some of the evaluations methods for apps and in particular weight management and monitoring apps.

## **2.4 EVALUATION OF WELLNESS MONITORING SERVICES**

This section presents an overview of some of the available evaluation methods of wellness monitoring services that have been conducted by other researchers. A review of the methods of evaluation of wellness monitoring services will provide a background to this research and contribute to meeting one of the main research objectives of this research, which is identifying a method for evaluating weight management and monitoring apps and then applying the identified evaluation method to the most popular weight management, weight loss, and diet apps.

### **2.4.1 Inclusion and Exclusion Criteria**

Analysing several papers that aim to evaluate wellness apps reveals that the evaluation process of apps usually starts with identifying inclusion and exclusion criteria. *Inclusion criteria* are a list of requirements, which a person/object has to meet

to be qualified to contribute in evaluation. *Exclusion criteria* are characteristics that would prevent a person/object from being qualified to join in a study (University of Pittsburgh 2011). In Azar et al.'s study (2013) aiming to evaluate diet/nutrition and anthropometric tracking apps, the inclusion criteria to select apps for review from the 'Health and Fitness' section in the iTunes App Store were: the app have to be ranked in the top 200 free apps in Health and Fitness category of the iTunes App Store; the primary goal of the app was to monitor dietary behaviors and/or anthropometric measurement; and the app had a stand-alone functionality which means it can operate without subscription to another program (Azar et al. 2013). The exclusion criteria for their study were excluding apps that only focus on physical activity because they were not meeting their research objectives; and excluding apps that emphasise only a specific diet subcategory (i.e. gluten-free) because of limited generalisability (Azar et al. 2013). Likewise, in the study that aimed to examine the content of popular apps for smoking cessation for both iPhone and Android operating systems by Abroms et al. (2013), the inclusion criteria were selecting the top 50 most popular apps, English language, apps had to be purely related to smoking, and high popularity. Popularity used to define the sample differs across operating systems. For Android, they consider the total worldwide app downloads as a proximate for popularity. However, for iOS, they consider the display order of search results on the computer monitor as the indicator of popularity (Abroms et al 2013).

There are several studies that identify words or phrases as search queries to specify search results in order to gain more relevant search returns that meet their research aims and objectives. To illustrate, in a study on Apple App Store to identify how much smartphone apps for weight control adhere to evidence-informed practices by Breton et al. 2011, the phrases "weight loss" and "diet" were used as search queries as they claim there are more than 1,400 apps in the "Healthcare & Fitness" category in Apple App Store. Likewise, Abroms et al. 2013 used the search terms "quit smoking", "stop smoking", and "smoking cessation" because the amount of apps available exceeded their resources.

One reason for identifying inclusion and exclusion criteria is to limit the number of apps to be evaluated when the number of apps in Apple store and Android market is too large. Abroms et al. (2013) utilised their inclusion criteria in evaluating apps, as the

volume of apps in Apple store and Android market exceeded their available resources. Likewise, as this study aims to evaluate weight management apps and as the number of Android and iOS apps exceeds the available resources for this study, identifying inclusion/exclusion criteria is essential for selecting apps from stores.

### **2.4.2 Methods of Evaluating Wellness Monitoring Apps**

The analysis of the literature has identified two methods to evaluate smartphone apps. Firstly, Harrison, Flood, and Duce's (2013) method that aims to evaluate apps according to PACMAD model (People At the Centre of Mobile Application Development). The PACMAD model includes the following elements: effectiveness, efficiency, satisfaction, learnability, memorability, errors, and cognitive loads. Besides, it considers three factors: user, task, and context (Harrison et al. 2013). Each of these elements has its own utility to be evaluated. Secondly, there are several studies such as Breton et al. (2011), Azar et al. (2013), IMS (2013), and Abroms et al. (2013), which have evaluated wellness apps by first identifying specific usability elements and then evaluating apps according to presence or absence of these elements in apps. Each of these studies has its scoring system for apps. To illustrate, Breton et al. (2011) examine each applications contents based on the 13 elements (see section 2.4.3). If the element is present in the app, then the app would take a specified score and then the app scores of all 13 elements are calculated and total scores made into an index score. By evaluating several apps based on specified usability elements, each app should have its index score value. A number could represent the presence or absence of an element such as in the IMS Institute for Healthcare Informatics (2013) study and Abroms et al. study (2013). For example, in Abroms et al. study each item was coded as 0 indicating "not present at all", 1 indicating "partially present", or 2 indicating "fully present". It also could be coded as yes=1 and no=2 as in Azar et al. (2013) study, or presence of elements could be represented by "X" = 1 like in Breton et al. (2011) study.

### **2.4.3 Elements of Evaluation Framework for Wellness Monitoring Applications**

Breton et al.'s (2011) evaluation framework for weight-loss monitoring applications includes the assessment of 13 elements. Breton et al.'s (2011) framework elements was built based on adherence to evidence-informed practices common to all of the following governmental agencies: the Centers for Disease Control and Prevention, National Institutes of Health, the Food and Drug Administration, and the US Department of

Agriculture. The following table shows the 13 elements, which used to investigate usability of apps in Breton et al.'s (2011) evaluation framework:

**Table 2.1: Breton et al.'s (2011) Evaluation Framework Elements**

Breton et al.'s (2011) evaluation framework Elements	
1	Does the app calculate users weight
2	Does the app give a recommendation on a certain number of daily serving of vegetables and fruits
3	Does the app suggest a certain amount of physical activity each day/week
4	Does the app suggest a certain number of daily servings of water or enable users to track their daily servings of water
5	Does the app have a food diary
6	Does the app allow users to calculate the number of calories needed in order to meet desired weight loss/maintenance goals given one's activity level
7	Does the app suggest weight loss goals of 1 to 2 lb/week
8	Does the app describe or illustrate portion sizes
9	Does the app suggest reading labels, describe how to properly read labels, or permit users to look up nutritional information for food items
10	Does the app provide a means to track weight over time
11	Does the app provide a means to track daily physical activity
12	Does the app recommend users plan their meals, have a tool for menu planning, or a way to search recipes
13	Does the app enable users access to social support components like message boards, chat rooms

Adopted from Breton et al (2011).

Azar et al.'s (2013) evaluation framework for diet/nutrition and anthropometric tracking apps is based on incorporation of features consistent with theories of behaviour change. The elements of the evaluation framework are categorised in five categories that include different elements as follows:

**Table 2.2: Azar et al.'s (2013) Evaluation Framework Elements**

Azar et al.'s (2013) evaluation framework Elements	
1	Knowledge (includes general information)
2	Cognitive strategies (includes perceived benefits, perceived barriers, perceived risks, self-efficacy, self-talk, perceived social norms)
3	Behavior strategies (includes Self-monitoring, Realistic goal-setting, Time management, Stimulus control, Self-reward, Social support, Modeling/vicarious learning, and Relapse prevention)
4	Emotion- focused strategies (Stress management, Negative affect management)
5	Therapeutic interventions (Skill-building/overview, Increasing knowledge, Motivational readiness)
6	Motivators (social praise, financial incentives, nonfinancial incentives)
7	Features that decreased barriers, such as tailored information
8	Triggers to promote continued use of the app (positive feedback for short- term task completion or automatic reminders/cues to use the app)

Adopted from Azar et al. (2013).

Azar et al. (2013) claim that engaging a tool called “persuasive technology content survey” adopted from Fogg Behavioral Model (FBM) is required because traditional behavioral theories may not address the adaptive and persuasive nature of new technologies. Thus, the apps were also scored on the presence or absence of FBM main components which is including the following three attributes motivators, features that decreased barriers, and triggers to promote continued use of the app (See table 2.2).

Table 2.3 demonstrates the evaluation elements of IMS (2013), which aimed to evaluate healthcare apps in the U.S. Apple App store. However, this framework is more general than Azar et al. (2013) and Breton et al. (2011) frameworks because it includes evaluations of all healthcare apps.

**Table 2.3: IMS Institute for Healthcare Informatics’s (2013) Evaluation Framework Elements**

IMS Institute for healthcare informatics (2013) Evaluation Framework Elements	
<b>1</b>	Information (includes level of detail of information, provides information as text, provides information as picture, provides information as video, provides audio information)
<b>2</b>	Instruction (provides instructions to the user)
<b>3</b>	Tracking and guidance (includes ability to track and capture user entered data, graphically displays user entered data, outputs user data, can link to sensor, provides guidance based on entry)
<b>4</b>	Reminder (built in reminder function)
<b>5</b>	Communication (uses email, provides secure communication, provides link to social networks)
<b>6</b>	Use of phone functionality (use of phone’s GPS, use of phone’s camera, use of phone’s scanner, use of phone’s voice recorder) (IMS 2013)

Adopted from IMS Institute for healthcare informatics (2013).

## **2.5 CHAPTER REFLECTION**

This chapter presented an overview of three areas namely wellness monitoring, ICT, and evaluation methods of wellness monitoring services with specific focus on weight management apps. These areas can be identified as providing beneficial insights to the research question. To summarise, the beneficial insights from the previous sections were:

- The rate of individuals who are overweight and obese has been increasing in Australia over the last two decades (ABS 2013; National Health and Medical Research Council 2014). Self-monitoring is sometimes considered the “cornerstone” and the most effective technique in behavioural management of obesity (Baker and Kirschenbaum 1993; Yeager 2014). Smartphone apps altered concept of self-monitoring by changing the isolated process of self-monitoring into a communal, supportive process where multiple individuals who have similar health interests can check the user’s progress and give encouraging feedback (Connelly 2006).
- Although mobile applications markets (iTunes and Google Play) list hundreds of thousands of health mobile applications, it is not always clear whether those applications are supported by credible sources (Choi and Stvilia 2014). Likewise, despite the prevailing use of smartphone apps to aid with weight management, the usability features of these applications are not well characterised (Azar et al. 2013).
- As there are too many apps related to weight management and diet in both stores (iTunes and Google Play), evaluating the usability of these apps is required. Several studies have evaluated wellness apps by first identifying specific usability elements and then evaluating apps according to the presence or absence of these elements in apps (Breton et al. 2011; Azar et al. 2013; IMS 2013; and Abroms et al. 2013).

The next chapter will present the methodologies of this research.

# Chapter Three

# Methodology

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### 3. METHODOLOGY

#### 3.1 INTRODUCTION

This chapter describes the methodology utilised in this research. The chapter is divided into the following sections:

- Section 3.2 demonstrates the research objectives and the developed research question.
- Section 3.3 presents the received ethical approval from Human Research Ethics Committee as one of the research stages includes reviewing apps user reviews.
- Section 3.4 demonstrates the research philosophy, which is subjective ontology and interpretivist epistemology that supported a qualitative method.
- Section 3.5 presents the strategy of this research. The content analysis is an important strategy that has been utilised in this research to develop the evaluation framework.
- Section 3.6 shows the three-stage research design. The design of this research includes three main stages: stage one- **Identifying Apps** includes a selective review of apps from iTunes and Google Play; stage two- **Development of the Evaluation Framework** utilised a content analysis of the literature; stage three- **Application of the framework** to the identified apps and included a deductive thematic analysis to examine apps user reviews.
- Section 3.7 shows the tools and techniques that supported the research strategy and carried out the research design. Stage one- **Identifying Apps** utilised a selective review of apps based on specified inclusion criteria. Content analysis used in stage two- **Development of the Evaluation Framework** that ease utilising the existing theories of evaluation frameworks to develop the suitable framework. Stage three- **Application of the framework** included practical application of the evaluation framework and deductive thematic analysis of apps user reviews.
- Section 3.8 the data of this study was analysed by content analysis, descriptive statistics and deductive thematic analysis.
- Section 3.9 describes the taken approach for the interpretation and discussion of this research.
- Section 3.10 presents the limitation of this research and some of the tactics used to address this limitation.



## **3.2 RESEARCH QUESTION AND OBJECTIVES**

The following sections demonstrate the research question and the suggested objectives.

### **3.2.1 Research Aims and Objectives**

This study aims to investigate the Australian smartphone stores (iTunes and Google Play) to examine the efficacy of health wellness apps, particularly in the arena of diet and weight loss as a review of the literature reveals that the rates of overweight and obesity have increased in Australia over the last two decades (ABS 2013; National Health and Medical Research Council 2014). One strategy to overcome this issue is self-monitoring, which is considered the most effective technique in behavioral management of obesity (Baker and Kirschenbaum 1993). Yeager (2014) claims that self-monitoring should be a main part of managing weight, weight-loss, or healthy lifestyle change.

Smartphone applications play an important role in monitoring and managing individuals' weight (Connelly 2006). Wellness monitoring applications are altering the concept of self-monitoring. Mobile technologies and applications allow people to monitor their weight more accurately than paper-based food or exercise diaries (Connelly 2006). Although mobile applications markets (iTunes and Google Play) list hundreds of thousands of mobile applications, it is not always clear whether those applications are supported by credible sources (Choi and Stvilia 2014). Likewise, Azar et al. (2013) points out that despite the prevailing use of smartphone apps to aid with weight management, the usability feature of these applications are not well characterised. Thus, this field needs a continual contribution to give users a clear insight on the most suitable apps for managing weight. Such studies are always wanted as the fast development nature of technologies and applications.

This research aims to achieve the following objectives:

1. Identify the most popular weigh management, weight loss, and diet apps according to specific criteria.
  - Develop an understanding of Australian weight management apps.
2. Identify/create a framework for evaluating these apps and apply this evaluation framework to the identified applications.
3. Compare the outcomes of the developed evaluation framework to specific metrics for justification.

### 3.2.2 Research Question

In order to meet the aforementioned objectives, the following research question has been developed:

How can a usability framework inform download popularity of socially focused wellness smartphone applications?

### 3.3 ETHICS

This research required an approval for minimal risks as one of the research stages involves examining apps' users reviews (comments). The research has been approved for minimal risks application from Human Research Ethics Committee (Tasmania) Network. The ethics Reference number for this research is H0014146.

### 3.4 PHILOSOPHICAL PERSPECTIVES IN THE RESEARCH

This section demonstrates the research philosophy and introduces the ontological and epistemological positions taken by the research.

Guba and Lincoln (1994) describe a philosophy as a set of beliefs in regards to the social reality nature, which includes the world nature and the nature of individual in the world. According to Guba and Lincoln (1994), a philosophy has three dimensions, namely, ontological, epistemological, and methodological. While the *ontological* dimension asks the question of what is the form and nature of reality, the *epistemological* dimension asks about the relationship between the researcher and the knowledge that will be gained. The *methodological* dimension investigates how the researcher realises that their belief could be known (Guba and Lincoln 1994). The aforementioned questions have been utilised to present the ontological, epistemological, and methodological stance for this research.

#### 3.4.1 Ontology

Ontology is the science, or the analysis of 'How it is?' 'What does it mean to be?' and 'What is?' (Becker and Niehaves 2007; Stahl 2007). The word means 'speaking of being' and theory of reality (Stahl 2007). Ontology is considered as the empirical world that could be either subjective (exist through actions of individuals in the world) or objective (exist without human interaction) (Orlikowski and Baroudi 1991).

Research that is underpinned by the objective ontology accepts that the studied phenomena is viewed objectively, and exists without human interactions. The examiner should be capable of examining the object without being influenced by the object or influencing it. The validity of the study can be threatened by any reduction in independence or when influence in either way is accepted (Shanks 2003; Guba and Lincoln 1994; Orlikowski and Baroudi 1991). Simply put, research underpinning this tradition of ontology assumes reality is objective, tangible, driven by causal laws, researcher and phenomena are detached, it aims to define causal explanations and inquiry is value free (Frank 2003; Shank 2003; Guba and Lincoln 1994; Orlikowski and Baroudi 1991; Agostinho 2005). Research contained within subjective ontology, on the other hand, assumes reality is subjective, constructed by humans, difficult to understand and explain, the researcher needs to interact with phenomena to construct reality, it is impossible to differentiate causes from effects, and inquiry is value bounded (Frank 2003; Shank 2003; Guba and Lincoln 1994; Orlikowski and Baroudi 1991; Agostinho 2005). Therefore, it requires interpretations in order to be understood (Orlikowski and Baroudi 1991).

This research is an exploratory study. In order to answer the proposed research question, a subjective ontology is acknowledged. The aim of this research was to gain an understanding of the current available evaluation frameworks to evaluate wellness apps and apply the evaluations to the identified apps. Becoming familiar with the literature and the evaluation frameworks was required to understand the meanings that were assigned to them. Also, the subjective ontological position enables the interpretive use of the non-numerical data of the content analysis and the users' reviews, which forms a part of the research data collection. Therefore, the subjective ontology is the most suitable ontology for this research.

### **3.4.2 Epistemology**

Epistemology is the science or theory of knowledge (Stahl 2007; Chua 1986). Research that aims to create knowledge needs to be based on explicit or implicit epistemology (Stahl 2007). The main stances of epistemology in regard to information systems (IS) research include, but are not limited to, positivism and interpretivism.

It argues that positivism and interpretivism paradigms, which are two different schools of thoughts, rely mainly on different assumptions in regard to the nature of

knowledge and require different research approaches (Cavaye 1996). Positivism philosophy assumes reality is objective, tangible, single, driven by causal laws, researcher and phenomena are detached, time and context free generalisation is possible, it aims to define causal explanations and inquiry is value free. Whereas, post-positivism philosophy assumes reality is subjective, constructed by humans, multiple, difficult to understand and explain, researchers need to interact with phenomena to construct reality, it is impossible to differentiate causes from effects, and inquiry is value bounded (comparison between the positivism and interpretivism illustrated in table 3.1) (Frank 2003; Shank 2003; Guba and Lincoln 1994; Orlikowski and Baroudi 1991; Agostinho 2005). The research under positivism (e.g. Leidner and Jarvenpaa 1993) and interpretivism (e.g. orlikowski 1993) paradigms are both suitable in IS. However, according to Stahl (2007), in recent IS researches, interpretivist paradigms are becoming more prevalent than positivism paradigms.

**Table 3.1 Positivism vs. Post-positivism**

	Positivism Philosophy	Post-Positivism Philosophy
<b>Epistemological position</b>	Dualist, and objectivist. Value-freedom: the research focus on objectives criteria in term of the choice of what to study, and how to study it. It does not focus on human beliefs and interests (Frank 2003).	Modified objectivist/dualist. Uncontrolled dualism, it requires a critical tradition and critical community. Subjectivity is accepted (Guba and Lincoln 1994).
<b>Ontological position</b>	Naïve realism. Reality exists, and is driven by general causal mechanisms and laws. It works according to the laws of cause and effect, time-context-free generalization, these laws can be revealed (Shanks 2003; Guba and Lincoln 1994).	Critical realism. Reality exists but it imperfectly understood or explained, there are multiple causes and effects.
<b>The nature of reality</b>	Reality is objective, tangible, single (Frank 2003).	Reality is subjective, Constructed by human, multiple (Frank 2003; Orlikowski and Baroudi 1991).
<b>The investigator role towards the phenomena</b>	Positivist researchers assume objective reality independently exists without their interaction; they remain neutral, objective, and detached. (Frank 2003; Shank 2003; Guba and Lincoln 1994).	Researcher needs to interact with phenomena to construct reality (Frank 2003).
<b>The role of values</b>	Inquiry is value free (Frank 2003; Shank 2003; Guba and Lincoln 1994).	Inquiry is value bounded (Agostinho 2005).
<b>Causality</b>	The research aims to define causal explanations (Frank 2003).	It is impossible to distinguish causes from effects (Agostinho 2005).
<b>Generalizability</b>	Time- and context-free generalizations (Guba and Lincoln 1994).	Only working hypotheses are possible to generalize (Agostinho 2005).

The interpretivist epistemological stance is adopted for this research. For the purpose of this study, the interpretivist paradigm is discussed below:

### **Interpretivism**

Interpretivist research philosophy;

*“aims to give a deep insight into the complex world of lived experience from the point of view of those who live it”* (Schwandt, 1994, p. 118).

According to Orlikowski and Baroudi (1991), interpretive philosophy assumes that as individuals interact with the world around them, they create and assign their own subjective and intersubjective meanings to it. The philosophical base of interpretive research is phenomenology and hermeneutics (Boland, 1985). Doolin (1994) claims that reality and our knowledge of it need interpretations from social actors who built it and to make a sense of that reality to be understood. Such philosophy aims to understand phenomena through the senses and meanings that the individual assigns to them (Myers 1997). Orlikowski and Baroudi (1991) point out that a shared social reality can be created through continuous social interaction, and it can only be interpreted rather than discovered. Therefore, meanings and norms can be converted to objective (inter-subjective) reality, through the process of continual social interaction (Doolin 1994). According to Walsham (1993), interpretive methods of research in IS aim to create an understanding of the IS context and its processes by the influences of IS and by studying how it is influenced by the context.

### **3.4.3 Methodology**

The methodology is a dimension influenced by the philosophy underpinning the research, which is a subjective ontology, interpretivist epistemology. The following definition illustrates the interconnections between the aforementioned three dimensions:

*“Qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them”* (Denzin and Lincoln 2005, p.3).

Thus, a qualitative methodology is suitable for this research.

Section 2.4 demonstrated the research philosophy and introduces the ontological and epistemological positions taken by the research and the reasons for the suitability of the adopted research philosophy. The philosophy underpinning the research is a subjective ontology, interpretivist epistemology supporting a qualitative method. The next section will present the strategy of the research.

### **3.5 RESEARCH STRATEGY**

This section presents the research strategy. The research strategy aids in realising the drivers behind selecting the proposed methods to explore the research question that was introduced in section 3.4.3. According to Thornhill, Saunders, and Lewis (2009), no research strategy is better than any other strategy. Consequently, selecting the research strategy should be based on whether the selected strategy will allow the researcher to answer the research question and meet its objectives. The research question and its objectives, the extent of existing knowledge, the research philosophy underpinnings, the available resources such as time, should all guide the researcher in selecting the research strategy (Thornhill, Saunders, and Lewis 2009).

A review of the literature of evaluation wellness monitoring services has shown that answering the research question may be problematic. Thus, the research strategy is a phased approach because the researcher first has needed to understand the current available evaluation methods for wellness monitoring services, with a particular focus on evaluation of weight management wellness services, and then the researcher can address the research question.

Content analysis is an important strategy that has been utilised in this research. The content analysis enables the development of the proposed evaluation framework by critically analysing the relevant literature. Qualitative content analysis is a valuable alternative to more traditional quantitative content analysis, when working in an interpretive paradigm (Zhang and Wildemuth 2008). Qualitative content analysis, which is inductive in nature, is suitable for studies that aim to explore phenomena. Thus, it is appropriate for analysing the literature. Through utilising constant comparative and interpretive memos aspects that included in a content analysis (Zhang and Wildemuth 2008), an understanding about the methods of evaluating weight management smartphone apps will increase. Hence, this strategy is suitable for the proposed research philosophy.

This section has presented the research strategy adopted in this research to ensure that the research question can be answered and the objectives can be met. This section has also demonstrated the appropriateness of the research strategies for this research, as they are consistent with the research philosophy and the phenomena under examination.

### **3.6 RESEARCH DESIGN**

This section explains the design of the research. The research design allowed addressing the research question and objectives. The research design was guided by the research philosophy and strategy.

The design of this research includes three main stages: stage one- **Identifying Apps**, stage two- **Development of the Evaluation Framework**, stage three- **Application of the framework**. This design guarantees a holistic view of the proposed research question.

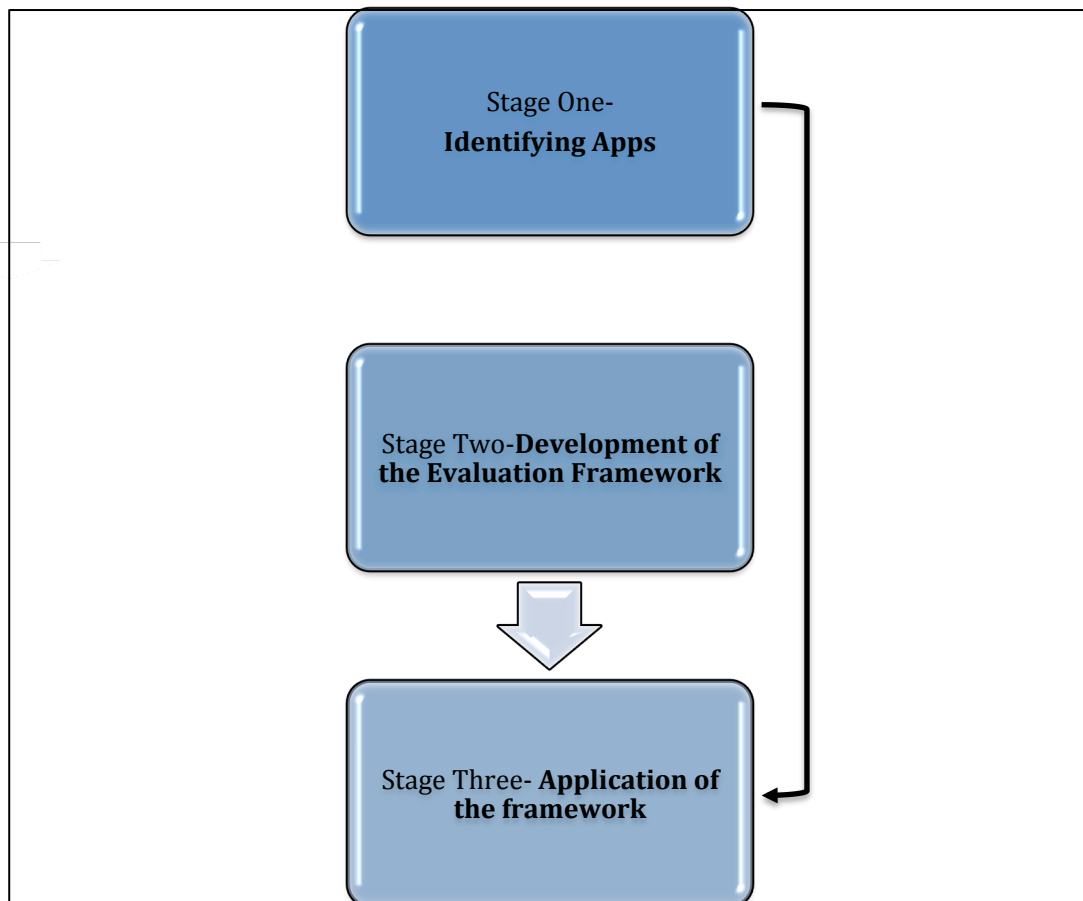
Stage one, **Identifying Apps**, included a review of the apps that located in the Apple App Store and Google Play store. This review was based on predefined inclusion and exclusion criteria. The inclusion criteria for selecting the apps from the store were as follow:

- Free (no charge),
- High star rating,
- App language is English,
- Consumer oriented app,
- App should be related to weight loss, diet or management,
- Top popular app,

The app was excluded if it did not meet any of the inclusion criteria. The process of identifying apps involved using specific key terms as a search queries to include the desired apps from the two stores. The key terms were “weight loss”, and “diet”. This data that was gathered in the stage one- **Identifying Apps** was a prerequisite for entering the data into stage three- **Application of the framework** (see figure 3.1). By the end of this phase, the total number of apps that were included because they met the inclusion criteria were identified, and the total number of apps that were excluded because they did not meet the criteria were identified. Due to time constraints of this study this research only examined the top 30 popular apps from each store.

Stage two, **Development of the Evaluation Framework**, utilised a content analysis of the literature to build a suitable evaluation framework that enabled a meaningful evaluation of the weight loss and diet apps. The literature was critically analysed to identify the required elements of the evaluation framework. This stage is based to allow conducting stage three- **Application of the framework** (see figure 3.1). Chapter 5 later demonstrates the outcomes, discussion and interpretation of weight loss and diet evaluation framework.

Figure 3.1 Research Design



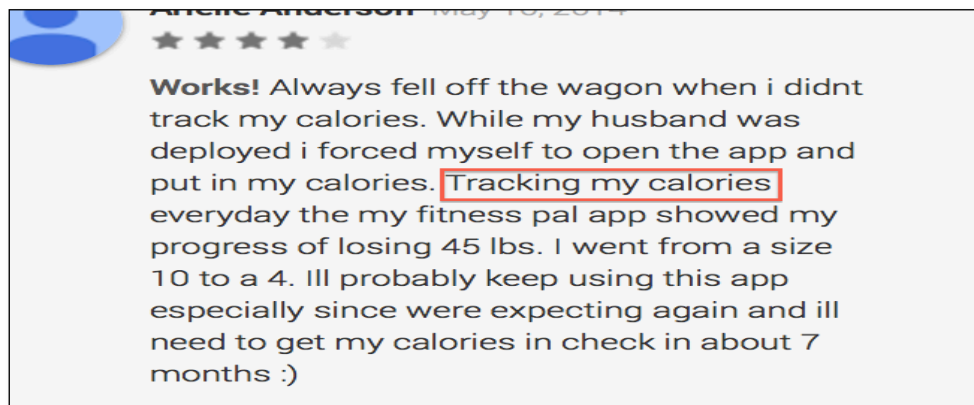
Stage three- **Application of the framework** involved reintroducing the apps that were included according to the inclusion criteria and applying the developed evaluation framework to each app. The data in this stage was influenced by stage two- **Development of the Evaluation Framework** (see figure 3.1). Thus, if the elements of the evaluation framework existed in the app, 'X' was assigned as value to indicate to the existence of the element in the app. Otherwise, the cell would be empty. After implementing stage three **Application of the framework** to all of the identified apps,



the apps ranked according to the framework. This method of evaluating content (developing index based on certain elements for evaluation and then determine the adherence to these elements), is a valid method that used by others doing similar evaluation of apps study (Breton et al. 2011; Abroms et al. 2013, Azar et al.2013, and MIS 2013).

After giving the apps index score values, a deductive thematic analysis was conducted to search patterns in the apps users' reviews. The thematic analysis phase is considered a part of this stage and is not a separate phase, as the patterns that were searched for in the users' reviews should be matched in wording, or meaning to the elements of the evaluation framework. New patterns that were discovered from the thematic analysis were also considered (see chapter 7). The most recent users reviews for both iTunes and Google Play stores were analysed (available user reviews for all the months of 2014). Figure 3.2 illustrates an example of a Google Play user review for *Calorie counter and diet tracker* app user review.

**Figure 3.2: A Screenshot of App User Review**

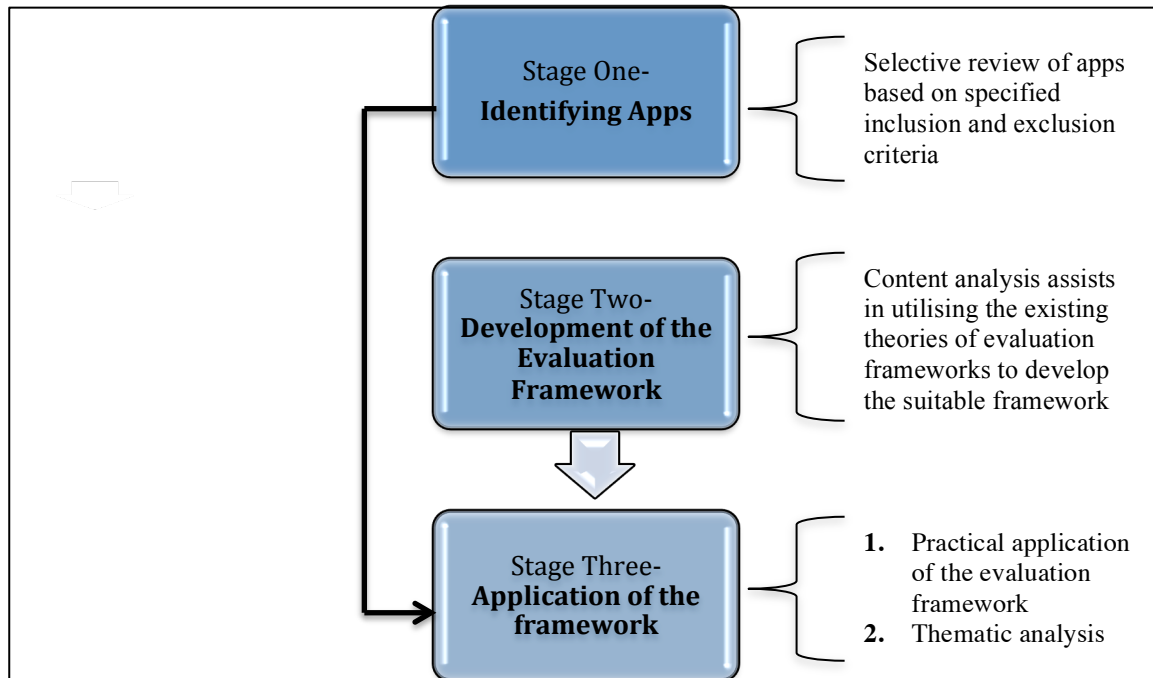


Section 3.6 has presented the research design. The next section will demonstrate the tools and techniques used in each of the design stages.

### **3.7 RESEARCH TOOLS AND TECHNIQUES**

This section shows the tools and techniques that supported the research strategy (see section 3.5) and carried out the research design (see section 3.6). The tools and techniques are used in research to facilitate and collect empirical evidence (Cavaye 1996). The tools and techniques for this research are presented in figure 3.3. The following subsection details the research tools and techniques that were utilised during each stage of the research design.

Figure 3.3: Research Tools and Techniques



### 3.7.1 Selective Review of Apps

Stage one- **Identifying Apps** included selective review of apps, which aimed to collect apps from the Apple Apps store (iTunes), and Google Play market based on specific inclusion criteria that were determined earlier in section 3.5.

*First*, the iTunes apps were collected between 24 to 25 June of 2014, using the search terms “**weight loss**” and “**diet**”. The Google Play apps were collected on 26 to 30 June of 2014. The list of possible apps for the iOS was obtained using the iTunes version 11.2 and for Android using the Google Play. Furthermore, Excel 2007 were utilised to lay out all the apps names that resulted from the following search queries “**weight loss**” and “**diet**”.

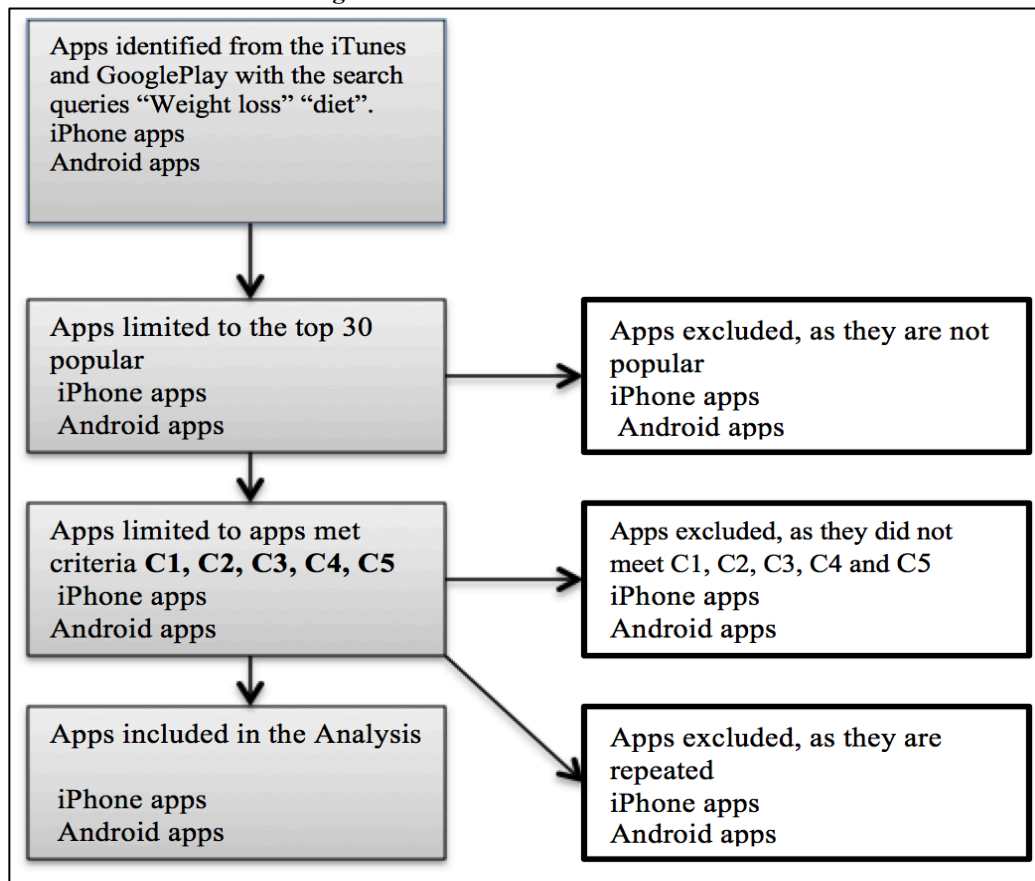
*Secondly*, the 30 most popular apps in the iTunes on 25 June 2014 were collected. The 30 most popular apps for Android were collected on 4 July 2014. **Popular Apps** are the Apps that have been downloaded the most during a certain period of time. The Abrams et al. (2013) method to measure the popularity of iTunes apps was followed in this research. Since iTunes does not provide an estimate of the number of downloads of Apps, the displayed ordered of search queries on the computer monitor were used as an indication of Apps’ popularity. Apps found on the top of the list are categorised as the most popular (Abrams et al. 2013) and hence the first 30 displayed apps were selected. Unlike iTunes, Google Play store provides the worldwide total number of downloads

for each app, which has been utilised as a proxy of apps' popularity. Therefore, the 30 apps that have been downloaded the most were considered as the most popular Android apps.

*The third step*, the apps that met following criteria were included in the research: **C1:** free (no charge), **C2:** app language is English, **C3:** consumer oriented app, **C4:** the app should be related to weight management, **C5:** apps with high star ratings (1 and 2 considered low ratings, 3 stars standard, 4 and 5 stars considered high rating). In addition, to review these criteria the Breaton et al. (2009) method was utilised. The iTunes and Google Play description page for each app was used as a base of review. The description page of both stores include a list of features the app offers, user ratings, customer reviews, and one to four screenshots of what the app looks like when downloaded.

After all the aforementioned refinements, the numbers of apps that were included in the analysis from both stores was known. The apps that resulted from the previous refinements were only considered, the rest of the apps were excluded and not analysed in this study. Figure 3.4 summarises the process of apps selective review.

Figure 3.4: Selective Review Process



### **3.7.2 Content Analysis**

Stage two- **Development of the Evaluation Framework** included utilising principles of content analysis to analyse previous studies that related to evaluating wellness apps. Content analysis methods were utilised to draw on existing theories (section 2.4) to develop the evaluation framework that suited weight loss/diet apps.

The content analysis investigated the manifest content of the material. The level of content could be themes and main ideas of the text as primary content or context information as latent content (Mayring 2000). Patton (2002) defines content analysis as:

*“any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings” (p.453).*

### **3.7.3 Practical Application of Evaluation Framework and Thematic Analysis**

Stage three- **Application of the framework** started on 14 July 2014. The stage followed Breton et al.'s (2011) method of applying their evaluation framework to the wellness smartphone apps. Breton et al. (2011) utilised Excel in applying their frameworks to the apps. The application of an evaluation framework required downloading the desired apps that resulted from stage one- **Identifying Apps**. After an app was downloaded, the presences of the framework components in apps were examined (see section 3.6). When the app satisfied a framework component then an “X” was assigned as a code that indicates the presence of the framework component (X= 1). After investigating the nine components of the framework, a value was assigned to the **Index Score**. After applying the framework to all apps for both stores separately, the apps were ranked.

#### **User Reviews**

After completing stage three- **Application of the framework**, a deductive theoretical thematic analysis for examining users' reviews (comments) of the apps has conducted as one of the objectives of this research aims to compare the outcomes of the developed evaluation framework to specific metric for justification (see section 3.2.1). It conducted on 4 August 2014. The user reviews were used as an additional data collection source to supplement the information collected from stage three- **Application of the framework**. The theoretical thematic analysis was used to search for specific

patterns in the users' reviews that matched the elements of the evaluation framework (see section 3.6). In addition, new patterns were taken into account.

User reviews are one of the important parts of user experience (Koyani et al., 2004). In the context of mobile applications, this model of crowd-sourced opinion is quite new, offering users direct access to information that can influence their purchasing/downloading decision (Vasa et al. 2012). The authors claim that better understanding of particular aspects of reviews that users leave on an app can be helpful for both developers and users in the highly competitive nature of mobile apps (Vasa et al, 2012). User generated online reviews implicitly communicate user perceived quality, from which "perceived ease of use" and "perceived usefulness" may be inferred (Vasa et al. 2012, p.241). Positive reviews assist users to find good apps; negative reviews can inform developer about weaknesses of app and thus can improve it and it also inform the users about weakness of the app hence avoid it (Vasa et al 2012; Tan and Vasa 2011). Choi and Stvilia (2013) utilise users' reviews in their study to investigate use of smartphone wellness applications and perceptions of application quality and usefulness. Thus, analysing user reviews added a further step to this research as it places the lens on the developed evaluation framework elements. In addition, add additional insight of missed elements that did not included in the developed evaluation framework.

Section 3.7 presented the tools and techniques that supported the research strategy and carried out the research design. The next section will demonstrate in the data analysis tools that were used in this research.

### **3.8 DATA ANALYSIS**

As discussed in the beginning of this chapter, the research data was qualitative in its nature and therefore needed a subjective ontological and interpretative epistemological research philosophy (see section 3.4). The data of this study was analysed by content analysis, descriptive statistics and deductive thematic analysis. The following sections explored the two analytic methods in more detail.

#### **3.8.1 Content Analysis**

There are two types of content analysis qualitative content analysis and quantitative content analysis (Zhang and Wildemuth 2008). Qualitative content analysis has been used as qualitative content analysis is mainly inductive, grounding the examination of

topics and themes, and the inferences drawn from them, in the data (Zhang and Wildemuth 2008). Stage two - **Development of the Evaluation Framework** benefited from the qualitative content analysis as it involved a process designed to condense raw data into categories or themes based on acceptable inference and interpretation (Zhang and Wildemuth 2008).

According to Zhang and Wildemuth (2008), the process of qualitative content analysis often begins during the initial stages of data collection. The early involvement of content analysis allows the researcher to critically investigate the available evaluation methods of apps. Thus, content analysis aided in delivering one of the research objectives for this research. To allow reliable and valid interpretations, there is a set of systematic and transparent procedures for processing data by content analysis (Tesch, 1990). According to Zhang and Wildemuth (2008), although there are several steps for conducting a content analysis, the content analysis may be more flexible and does not need to include all the steps of content analysis depending on the goals of the study. Thus, as this research goal is to understand the ideas of evaluation wellness smartphone apps, this study was less standardised in following the exact steps of content analysis.

Qualitative content analysis utilises themes and hence it was more suitable for this research than a quantitative content analysis that merely allows using the physical linguistic units (e.g., word, sentence, or paragraph). An instance of a theme may be articulated in a single word, a phrase, a sentence, a paragraph, or an entire document (Zhang and Wildemuth 2008). According to Minichiello et al. (1990), when using a theme as the coding unit, the researcher is mainly searching for the expressions of an idea. Therefore,

*“the researcher might assign a code to a text chunk of any size, as long as that chunk represents a single theme or issue of relevance to his/her research question(s)”* (Zhang and Wildemuth 2008, p.3).

Qualitative content analysis does not generate statistical significance and counts; instead, it uncovers patterns, themes, and categories important to a social reality (Zhang and Wildemuth 2008). In this way qualitative content analysis allowed searching ideas of evaluating smartphone apps and hence allowed completing Stage two - **Development of the Evaluation Framework**.

### **3.8.2 Thematic Analysis**

According to Guest (2012), thematic analysis is the most usual form of analysis in qualitative research. Braun and Clarke (2006) claim that thematic analysis should be seen as a main method for qualitative analysis.

*“Thematic analysis is a method for identifying, analysing and reporting patterns, themes within data”* (Braun, and Clarke, 2006, p.79).

Patterns or themes within data can be identified in one of two primary ways in thematic analysis: in an inductive or ‘bottom up’ style (eg, Frith and Gleeson, 2004), or in a theoretical or deductive or ‘top down’ style (eg, Boyatzis, 1998; Hayes, 1997) (Braun, and Clarke, 2006). As the aim in this study was to identify specific predefined patterns that matched the elements of the evaluation framework (See section 2.5. and 2.6.3), the deductive style of the thematic analysis was suitable to achieve this aim.

*Deductive thematic* analysis tends to be driven by the researcher’s analytical or theoretical interests in the area and thus it is more explicitly analyst driven than inductive thematic analysis (Braun, and Clarke, 2006). In addition, deductive thematic analysis tends to provide a more detailed analysis of some aspects of the data (Braun, and Clarke, 2006). Thus, it was more appropriate for this study than inductive thematic analysis hence it will not be limited to coding words only. Furthermore, it enables applying some subjectivity in coding the user reviews. To illustrate, if a comment include the exact information, meanings, or indications of the framework elements (see section 3.6), it will be considered using deductive thematic analysis.

There are two levels to identify the themes when analysing data using thematic analysis method: the semantic/explicit level or latent/interpretive level. This study identified the patterns in *latent level* because thematic analysis at the latent level goes beyond the semantic content of data, and it examines the underlying ideas, assumptions, and conceptualisation, ideologies that are theorised as shaping or informing the semantic content of the data (Braun, and Clarke, 2006). However, at the semantic level, the patterns are identified as they explicitly appeared on the data, and the analyst cannot consider anything beyond what has been written or what a member said (Braun, and Clarke, 2006). Thus, conducting thematic analysis at a latent level was more appropriate to achieve the aim of this study than a semantic level.

## **METHOD OF DEDUCTIVE THEMATIC ANALYSIS FOR APPS USERS REVIEWS**

### ***Participants***

The data on which the deductive thematic analysis was based were collected from the latest 20 reviews (for 2014) of the identified iTunes and Google Play apps (see section 4.3 and 4.4) that were written by the apps' users.

### ***Material***

There were a vast number of user reviews particularly in Google Play store. Only the latest reviews were selected for the analysis specifically reviews from 2014, as they were the most recent reviews and due to the time constraints of this research. The selected reviews text or data set (the data utilised in analysis which identified by a particular analytic interests) was analysed using deductive thematic analysis (Braun & Clarke, 2006; and Lambert and O'Halloran 2008).

### ***Design***

The design of analysis was qualitative using the method of deductive thematic analysis by Braun and Clarke (2006), and Lambert and O'Halloran (2008). Their styles were suitable for analysing the users reviews as they assisted in the interpretation of identifiable patterns and themes. The process of conducting thematic analysis includes six main stages: familiarising with data, generate initial codes, searching for themes, reviewing themes, defining and naming themes (categorising), and producing the report (Braun and Clarke 2006; Lambert and O'Halloran 2008).

### ***Procedure***

The latest user reviews were collected from the iTunes and Google Play. Detailed deductive thematic analysis for the reviews was conducted based on the guideline of Braun & Clarke (2006) and Lambert and O'Halloran (2008).

According to Braun & Clarke (2006), there are several ways to proceed with reading for thematic analysis. However, it should be taken in account that an inductive approach does not require engaging with literature in the early stages of analysis, whereas a theoretical approach requires engagement with the literature prior the analysis (Braun & Clarke 2006). In this research, some of the discovered patterns were related to the elements of the evaluation framework, which were developed based on the literatures (see section 5.4).

As this was a qualitative analysis, it was recursive process, where movement was back and forth as needed throughout the stages. It was not a linear process, which



merely includes moving from one stage to another (Braun and Clarke, 2006). The following table shows Braun and Clarke (2006) deductive thematic analysis stages:

**Table 3.2: The different stages of thematic analysis (Braun & Clarke 2006)**

Stage	Description of the process in the stage
1. Familiarizing with data	Transcribing data if required, read, and re-read the data, noting down opening ideas.
2. Generate initial codes	In a systematic way, code-interesting features of the data across the entire data set, collating data relevant to each code.
3. Searching for themes	Gathering codes into potential themes, and gather all data that relevant to each potential theme.
4. Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic ‘map’ of the analysis.
5. Defining and naming themes (categorizing)	Continual analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing the report	Selection of vivid, compelling extracts, and relating back of the analysis to the research question to produce a scholarly report of the analysis.

The following sections will describe in more details the aforementioned stages, which were followed in this study in analysing the users’ reviews:

### **Stage One**

The data corpus was read (all user reviews both past and recent reviews) and the data sets (newest reviews, 2014 user reviews) were identified (*familiarizing with the data*).

*“Whether or not the researcher aiming for an overall or detailed analysis, are searching for latent or semantic themes, or are data- or theoretically-driven will inform how the reading proceeds” (Braun & Clarke 2006, p.87).*

After the data set was read, it was considered that the required analysis for this research was a deductive analysis at the latent level. Thus, the engagements of the evaluation elements were considered at the early stages of analysis. In addition, as the analysis was at the latent level, reading the data set not only considered the semantic content but also meaning and assumptions of the semantic content. Notes were taken during this stage, as they were needed in the subsequent stages (see Appendix 12).

### *Stage Two*

The Google Play data sets were copied and pasted into an Excel sheet in table with two columns (in the left column). For iTunes user reviews, screen shoots of the reviews were taken instead in the left column, as iTunes did not allow copying users' reviews (see Appendix 13). All reviews were read in detail and then the early ideas and thoughts were written in the right column (*identifying initial codes*).

Braun & Clarke (2006) states that codes identify a feature of the data that may be semantic content or latent. This feature looks interesting to the analyst and refers to the most fundamental segment of the raw data or information that can be evaluated in a meaningful way regarding the phenomenon. Coding depends on whether themes are more theory driven or data driven. In the former, the data should approach with specific questions in mind that wished to code around. However, in the latter, the themes depend on the data (Braun & Clarke 2006). Themes in this research were theory driven as the elements of evaluation framework were in mind while analysing data and the data was approached and coded around them. Braun & Clarke (2006) points out that coding can be done either manually or through a software program. In this research coding has been done manually.

Table 3.3: Stage Two – Example of one of the Google Play’s Apps

Monitor Your Weight App Users' Reviews	Initial Codes
<b>Google Play User Review 1- August 26, 2014</b>	
Nice and simple I love it! Easy way to keep track and love the graphs!	Easy way to keep track
	Love the graphs
<b>Google Play User Review 2- August 25, 2014</b>	
The best weight monitor ever	Best weight monitor
<b>Google Play User Review 3- August 24, 2014</b>	
Does What it Says, and More It does what it says ad Web. Allows notes too. It now allows me to show a graph of my weight on my Web page and in the signature of forum posts This ability is scarily motivating. I can't hide from the flabby (but much thinner now thanks to this app) truth.	Allows notes
	Allow show a graph
	Includes forum posts
	Scarily motivating
	Thanks to this app
<b>Google Play User Review 4- August 23, 2014</b>	
What I wanted Just exactly what I wanted. I love that I can have Different profiles for different goals.	Exactly what user want
	Different profiles and goals
<b>Google Play User Review 5- August 22, 2014</b>	
Excellent Does everything I need to monitor my weight loss.	Enable monitor weight
<b>Google Play User Review 6- August 22, 2014</b>	
Helpful tool to see my weight loss progress	Helpful to see weight loss
<b>Google Play User Review 7- August 22, 2014</b>	
Very good software for tracking your wright	Enable tracking weight
<b>Google Play User Review 8- August 22, 2014</b>	
Superb I have used this app for over a month now whilst being on a diet and it's great for keeping track of your weight while the Guide keeps you on track to meet your weight loss targets. Highly recommended.	Keep tracking weight
	Guide to keep weight loss targets
<b>Google Play User Review 9- August 21, 2014</b>	
Monitor your weight	Monitor weight
<b>Google Play User Review 10- August 21, 2014</b>	
Very good app Monitor your weight is a really good app. I love the charted tracking and the graph . It's simple and exactly what I need.	Monitor weight
	Includes charted tracking
	Simple
<b>Google Play User Review 11- August 19, 2014</b>	
Good Stuff You need this if a graph helps keep you motivated in working off that weight.	Includes motivated weight graphs
<b>Google Play User Review 12- August 19, 2014</b>	
Graph is excellent! I love that the graph shows me my goal and actually Rate of progress. Really helps to visualize.	Graph shows goals
	Graph helps to visualize
<b>Google Play User Review 13- August 18, 2014</b>	
Great way of keeping track I used this app for my weight challenge and to continue to have the confidence off	Track user weight
Keeping the weight off.	Keeping the weight off
<b>Google Play User Review 14- August 18, 2014</b>	
Excellent App I love it because it helps me keep track of my weight and also shows me how far away from my goal that I am.	Help keep track of weight
	Show how far from goal

### Stage Three

The user reviews were re-read several times and the ideas and thoughts were converted into particular themes (*identifying themes*). According to Braun and Clarke (2006), this stage re-focuses the analysis at the broader level of themes, which includes arranging the different codes into potential themes, and gathering all the relevant coded data extracts in the identified themes. Thus, this stage aimed to gather and convert initial codes into potential themes. Unrelated notes were excluded and not coded.

**Table 3.4 Stage three- Example of one of the Google Play's Apps**

Monitor Your Weight App - Initial Codes	Identifying Themes
Easy way to keep track	Tracking
Love the graphs	Graphs
Best weight monitor	Weight Monitoring
Allows notes	Writing Notes
Allow show a graph	Graphs
Includes forum posts	Forums
Motivating	Motivating
Thanks to this app	Thanking
Exactly what user want	Meeting User Need
Different profiles and goals	Variety of Profiles and Goals
Enable monitor weight	Weight Monitoring
Helpful to see weight loss	Weight Losing
Enable tracking weight	Weight Tracking
Keep tracking weight	Weight Tracking
Guide to keep weight loss targets	Weight Loss Targets
Monitor weight	Weight Monitoring
Monitor weight	Weight Monitoring
Includes charted tracking	Charted Tracking
Simple	Simple
Includes motivated weight graphs	Motivated Graphs
Graph shows goals	Goals Graphs
Graph helps to visualize	Visualisation Graphs
Track user weight	Weight Tracking
Keeping the weight off	Weight Losing
Help keep track of weight	Weight Tracking
Show how far from goal	Weight Goal
Track my weight	Weight Tracking
History to see patterns	History
Can add a pin code	Pin Code
Good graphs	Graphs
Allow select metric sys.	Selecting Metric System
Allow enter weight	Entering Weight
Includes nice graph	Graphs
Add notes	Writing Notes
Easy enter data	Entering Data
Use a pin to lock app	Pin Code
Require close the app	Locking App
Access app without entering in pin	Pin Code
Simple and easy to use	Simple and Easy
Track weight day by day	Weight Tracking

### *Stage Four*

The data was re-read again and the themes were refined into more particular groups (*reviewing themes*). According to Braun and Clarke (2006), reviewing themes stage includes selecting the candidate themes and refinements of those themes. It may be that some candidate themes did not include enough data to support the theme. Also, it may be that two separate themes needed to be collapsed into each other. The opposite of this previous case might also happen where themes need to be broken into two separate themes (Braun and Clarke 2006). This research followed Patton's (1990) for dual criteria judging categories for internal homogeneity and external heterogeneity as advised by (Braun and Clarke 2006). As a result, data within themes were meaningfully cohering together and there were clear and identifiable distinctions between themes.

According to Braun and Clarke (2006), this stage includes two levels of themes reviewing and refinements. The first level includes reviewing at the level of the coded data extracts. To illustrate, candidate themes should adequately capture the contours of the coded data. The second level not only involves considering the validity of individual themes in relation to the entire data set, but also checking whether the candidate table is accurately reflecting the meanings evident in the entire data set.

This stage includes also re-reading of the data set as it allows checking whether the themes 'work' in relation to the data set, as well as, allowing coding of any additional data within themes that has been missed in the earlier coding stages. This process of reviewing and refinements stops when the table fit the data set (Braun and Clarke 2006).

Table 3.5: Stage four- Example of one of the Google Play's Apps

Monitor Your Weight App - Initial Codes	Reviewing Themes
Tracking	Tracking
Graphs	Graphs
Weight Monitoring	Weight Tracking
Writing Notes	Entering Data
Graphs	Graphs
Forums	Forums
Motivating	Motivation
Thanking	App Pros
Meeting User Need	App Pros
Variety of Profiles and Goals	Weight Loss Targets
Weight Monitoring	Weight Tracking
Weight Losing	Losing Weight
Weight Tracking	Weight Tracking
Weight Tracking	Weight Tracking
Weight Loss Targets	Weight Loss Targets
Weight Monitoring	Weight Tracking
Weight Monitoring	Weight Tracking
Charted Tracking	Graphs
Simple	App Pros
Motivated Graphs	Graphs
Goals Graphs	Graphs
Visualisation Graphs	Graphs
Weight Tracking	Weight Tracking
Weight Losing	Losing Weight
Weight Tracking	Weight Tracking
Weight Goal	Weight Loss Targets
Weight Tracking	Weight Tracking
History	Diary
Pin Code	Pin Code
Graphs	Graphs
Selecting Metric System	Searching Data
Entering Weight	Entering Data
Graphs	Graphs
Writing Notes	Entering Data
Entering Data	Entering Data
Pin Code	Pin Code
Locking App	Pin Code
Pin Code	Pin Code
Simple and Easy	App Pros
Weight Tracking	Weight Tracking

### Stage Five

After being satisfied with the themes created, the main themes can be categorised (Braun & Clarke 2006 and Lambert and O'Halloran 2008).

Table 3.6: Stage five- Example of one of the Google Play’s Apps

Monitor Your Weight App -Themes	Categories
Weight Tracking and Monitoring	Monitoring User Data
Graphs	Abstract and Reflective
Weight Tracking and Monitoring	Monitoring User Data
Managing Data	Controllable
Graphs	Abstract and Reflective
Forums	Social Support
Motivation	Motivation
App Pros	App Pros
App Pros	App Pros
Weight Loss Goals	Weight Loss Goal
Weight Tracking and Monitoring	Monitoring User Data
Weight Losing	Weight Loss Goal
Weight Tracking and Monitoring	Monitoring User Data
Weight Tracking and Monitoring	Monitoring User Data
Weight Loss Goals	Weight Loss Goal
Weight Tracking and Monitoring	Monitoring User Data
Weight Tracking and Monitoring	Monitoring User Data
Graphs	Abstract and Reflective
App Pros	App Pros
Graphs	Motivation
Graphs	Abstract and Reflective
Graphs	Abstract and Reflective
Weight Tracking and Monitoring	Monitoring User Data
Weight Losing	Weight Loss Goal
Weight Tracking and Monitoring	Monitoring User Data
Weight Loss Goals	Weight Loss Goal
Weight Tracking and Monitoring	Monitoring User Data
History	Trending and Historical
Pin Code	Public
Graphs	Abstract and Reflective
Managing Data	Controllable
Managing Data	Controllable
Graphs	Abstract and Reflective
Managing Data	Controllable
Managing Data	Controllable
Pin Code	Public
Pin Code	Public
Pin Code	Public
App Pros	App Pros

### Stage Six

The categories were reviewed to ensure that evidence from the raw data to represent the existence of each theme within the various categories (Braun & Clarke 2006 and Lambert and O’Halloran 2008). Words from the raw data were extracted to give evidence of the existence of each theme within the different categories (See chapter 7).

Appendix 13 shows an example of conducting the deductive thematic analysis on one of the iTunes app.

### **3.8.3 Descriptive Statistics**

Descriptive statistic is a way to describe the main features of the data in a study (Trochim 2006). It allows describing the distribution of and relationship among variables (Chambliss and Schutt 2012). According to Berger (2009), descriptive statistics indicate methods that use raw data to turn it into information, which summarises all sets of data. It summarise the sample and the measures. Together with simple graphics analysis, it forms the foundation of every numerical data (Trochim 2006). According to Trochim (2006), each descriptive statistic condenses data into a simpler summary. As a result, this may cause an issue of changing original data or losing significant details. However, given this limitation, still, descriptive statistic considers a strong technique that allows providing summary that may enable comparisons across people or other units (Trochim 2006).

Stage three- Application of the evaluation framework has resulted in many outcomes. Thus, descriptive statistics have used in this research to support categorization and further inform the findings. The central tendency of distribution (i.e. mean, median, and mode), tables, pie chart, columns, and bar charts all have utilised in this research to assist in reaching the main findings from several outcomes.

Section 3.8 discussed the data analysis tools of this research in more detail. The next section will demonstrate the approach of interpretation and discussion that used for interpreting and discussing the data analysed.

## **3.9 APPROACH TO INTERPRETATION AND DISCUSSION**

This section presents the approach taken to discuss and interpret the data analysed for phase two- **Development of the Evaluation Framework** and phase three- **Application of the framework** using the method discussed above. As this research was qualitative in nature, it required an interpretation and discussion for data that was analysed. The interpretation and discussion occurred in relation to the research question and objectives.

Phase two- **Development of the Evaluation Framework** compared the literature that was, reflective of the body of evaluating wellness smartphone apps at the time of data collection and analysis. The outcomes of the developed evaluation framework that



found based on the critical content analysis of the literature have supported by comparing to the current literature in the discussion and interpretation phase (see Chapter 5, section 5.3). The interpretation and discussion for phase two- **Development of the Evaluation Framework** enhanced the quality of interpretation of the research.

Phase three- **Application of the framework** also presented independently in separate chapter of the research and the developed evaluation framework. The main outcomes of this phase have supported by literature (see Chapter 6, section 6.5).

Also, as each phase of the design of this research did not completely answer the research question, Chapter 8 of this thesis assembled the main findings of the research and answering the research questions and associated objectives. Furthermore, Chapter 8 demonstrated the interpretation and discussion of these main findings. In addition, concepts maps may be utilised to emphasise relationships and connections among concepts. The interpretation of initial findings will be easier through use of a flexible approach to concept mapping. According to Kisber and Poldma (2010), concept mapping is a strategy used in qualitative research that allows keep tracking of data interpretations as they first begin to emerge. It enables documenting the relational features of initial data interpretations. Concept mapping can be done as rough, hand-drawn maps of initial ideas or as schematic diagrams that map out emergent thinking in the research. It assists in formulating analytic ideas as they are being conceptualized (Kisber and Poldma 2010) (see Chapter 8, section 8.1).

Section 3.9 presented the approach of interpretation and discussions of the data analysed in phase two and phase three. The next section will demonstrate the limitations of this research.

### **3.10 RESEARCH LIMITATIONS**

This section considers the limitations of this research and presents the tactics used to address some of the limitations.

General limitations of the research resulting from the qualitative nature of the research included limited generalisability of the results, which could not be avoided (Johnson and Onwuegbuzie 2004). The research only focused on apps related to weight management that have identified according to specific inclusion criteria and hence the developed evaluation framework is not applicable to other kinds of apps.

As the qualitative research requires more time for collecting research data comparing with quantitative research (Johnson and Onwuegbuzie 2004; Anderson, 2010), the relatively short duration of this study (6 months) constrained to reduce the number of apps included in the analysis.

The subjective nature of qualitative research makes it vulnerable to bias from the researcher (Denzin and Lincoln 2005). Reliability, validity and objectivity are criteria used to evaluate the quality of research in the usual positivist research paradigm (Zhang and Wildemuth 2008). However, as an interpretive paradigm varies from the positivist tradition in research purposes, fundamental assumptions, and inference processes, therefore these usual criteria were inappropriate for evaluating qualitative research results (Bradley, 1993). Hence, this research utilised Lincoln and Guba's (1985) four criteria: credibility, transferability, dependability, and confirmability for evaluating interpretive research work.

Credibility is defined as

*“adequate representation of the constructions of the social world under study”*  
(Bradley, 1993, p.436).

The credibility of this research was presented in the research design. Activities such as spending prolonged engagement with the phenomenon under study, triangulation, and checking interpretations against raw data can improve credibility of research outcomes (Lincoln and Guba 1985). The design of this research was built on researcher engagement with the research phenomena for a period of nearly four months. Two different data collection sources have been utilised to overcome the limitation of using single method.

Transferability refers to

*“the extent to which the researcher's working hypothesis can be applied to another context”* (Zhang and Wildemuth 2008, p.6).

Although as previously mentioned the research only focused on apps related to weight loss and diet that have been identified according to specific inclusion criteria and hence the developed evaluation framework is not applicable to other types of apps, the research can achieve transferability by giving rich data and descriptions to the other

researchers so that other researchers are able to make judgments about the findings' transferability to different settings or contexts. The literature review (see Chapter 2, section 2.4) and the transparent providing of data in methodology section added to the transferability of this study.

Dependability refers to

*“the coherence of the internal process and the way the researcher accounts for changing conditions in the phenomena”*(Bradley, 1993, p.437).

According to Zhang and Wildemuth (2008), dependability is determined by examining the consistency of processes in the study. After phase two-**Development of the Evaluation Framework** and evaluating apps according to the framework (phase three **Application of the framework**), a follow up step was conducted to perform a deductive thematic analysis of apps users reviews, focusing on the apps usability elements as well as checking the correctness of the evaluation framework and its outcomes.

Conformability refers to

*“the extent to which the characteristics of the data, as posited by the researcher, can be confirmed by others who read or review the research results”* (Bradley, 1993, p.437).

Zhang and Wildemuth (2008) point out that confirmability is established by examining internal coherence of the research product (i.e. data, results, interpretations, and recommendations). The conformability of this research was achieved through a clear and detailed providing of characteristics of data and research findings.

Section 3.10 has presented the limitations of the research and presented the method used to address the research limitations.

### **3.11 CHAPTER REFLECTION**

This chapter presented the philosophical position of the research. Utilising a qualitative approach that underpinned the subjective ontology and interpretive epistemology traditions was suitable for the exploratory nature of this research.

The research strategy consisted of content analysis and two-stage data collection. The chapter presented the research design that consisted of three research stages. This design was guided by the research strategy and philosophy and enabled to support each research stages focus.

The chapter has demonstrated the tools and techniques utilised to collect the data across the three stages of the research. There were multiple data collections used during research stages: Selective review of apps based on specified inclusion and exclusion criteria,. In addition, content analysis assisted in utilising the existing theories of evaluation frameworks to develop the suitable evaluation framework for this research. Furthermore, practical application of the evaluation framework, and deductive thematic analysis of apps user reviews were used during the three stages.

The chapter has presented the analysis method used in the research and the approaches for discussing and interpreting the analysed data. The limitations of this study and some of the tactics to overcome this limitation were discussed in the chapter. Lincoln and Guba's (1985) four criteria for evaluating interpretive research were applied to this research for evaluating interpretive research work.

The next chapter will present stage one data collection of this research.

# Chapter Four

# Identifying Apps

## Phase One

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## 4. IDENTIFYING APPS – PHASE ONE

### 4.1 INTRODUCTION

This chapter describes the selective review of apps from the Australian iTunes store and Australian Google Play market (see section 3.5 and 3.6.1). This chapter is structured in two parts. The first part demonstrates the process of selective review of apps from Australian iTunes store. The second part describes the procedure to selective review apps from the Australian Google Play market. Data that was gathered in this stage - **Identifying Apps** is a requirement for entering the data into stage three - **Application of the framework** (see section 3.5) and thus to answer the research question.

The structure of this chapter is as follow:

- Section 4.2 demonstrates description of the process to selective review apps from the Australian iTunes store.
- Section 4.3 illustrates the procedure to review apps from the Australian Google Play market.

### 4.2 SELECTIVE REVIEW OF APPS FROM AUSTRALIAN iTunes STORE

This section describes the components of the first stage- **Identifying Apps**, which includes the selective review of the apps, which are located in the Australian iTunes store.

The process of identifying apps from iTunes store involved using specific key terms as search queries to include the desired apps from the two stores. The key terms are “weight loss”, and “diet”. The idea of selecting certain apps based on specific search terms originates from previous work evaluating smartphone apps for weight loss and tobacco cessations (Breton et al. 2011, Abroms et al. 2013).

The selective review process was based on predefined inclusion and exclusion criteria (see section 3.5 and 3.6.1). The inclusion criteria for selecting the apps are as follow:

- **Free (no charge)**
- **High star rating (4 and 5 stars)**

These two aforementioned criteria have been selected as in the study of Choi and Stvilia (2014), exploring how college students choose and utilise mobile wellness applications; their preliminary findings reveal that the following criteria: free (no charge), and high star ratings are all considered to be the main factors for college students to select mobile wellness apps among alternatives.

- **App language is English**

In BinDhim et al's study (2014), the previous criterion was included in their examination of one of the free smoking cessation smartphone app (namely Quit Advisor app), and it was found that English is the most commonly spoken language for smartphones' users. BinDhim et al's study was conducted in Australia, U.S. and U.K. Result was reasonable, as English is the main language spoken in these three countries. Thus, as the present research was conducted on app from the Australian smartphone stores, the language used was English.

- **Consumer oriented app**

This criterion has been adopted because of this research purpose, which is aimed to evaluate apps that serve consumers not professionals (e.g. doctors or trainers).

- **App should be related to weight loss, or diet**

This criterion has been also created to serve the research purpose, as the present research aimed to evaluate weight loss and diet apps and not all apps.

- **Top popular app**

This criterion has been to directly inform the research question, which was “How can usability framework inform download popularity of socially focused wellness mobile applications?”.\*

The data that was gathered in this stage - **Identifying Apps** is a requirement for entering the data into stage three- **Application of the framework** (see section 4.5 and 4.6.1).

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\*Disclaimer: The popularity of ranking apps for the stores might be calculated differently. However, this research is accepting the popularity ranking provided by the stores and any exploration into the calculation of popularity ranking is beyond the scope of this research.

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### 4.2.1 Characteristic of iTunes Search Engine

The search terms were entered in a multiple of ways in the iTunes search engine (e.g. “weight loss”, “WEIGHT LOSS”, “Weight Loss”, and “Weight loss”) and the results were the same. Therefore, the iTunes search engine is not a case sensitive to the letters. For example, using “Diet” or “diet” produce the same results. Likewise, using “weight loss” or “Weight Loss” produced the same results. This research has used “weight loss” and “diet” search terms for identifying apps.

### 4.2.2 iTunes Rank Apps According to their Download Popularity

Google Play market provides the total number of downloads for each app within ranges. Thus, the download ranges identified the top popular apps. However, iTunes does not provide the total number of downloads for each app. Conversely, the function of iTunes to rank apps in the iTunes store includes the number of downloads for apps. According to Abroms et al. (2013),

*“the display order of search results on the computer monitor is primarily a function of downloads plus “other undisclosed factors related to popularity are included in its calculation” (Apple Inc. Customer Support, January 2012)” (p. 733 in Abroms et al. (2013)).*

Likewise, Rogers (2014) claims that although Apple keeps their apps ranking algorithm secret; it has been proposed that it includes the number of installs for applications. This means that if an app was more commonly used, it is going to be highly ranked in the iTunes store. Thus, identifying the top popular apps of the iTunes store has followed Abroms et al. (2013) method, which depends on the displayed ranking of apps. Thus, the first 30 displayed apps resulted from each search term were considered as the top 30 popular apps in the iTunes store.

### 4.2.3 Number of iTunes “Weight Loss” & “Diet” Apps and the Top Popular Apps

The total number of apps in the iTunes store as a result of the search terms “weight loss” and “diet” are 1000 apps. 500 apps resulted from the search term “weight loss” and 500 apps resulted from the search term “diet”. However, as mentioned



previously in this study, the restriction of the available resources for this study limited the number of apps included in the analysis. Thus, this study only focused on the top 30 popular apps that resulted from each term.

The apps were collected from the iTunes store on 24 June 2014 by using the search term “weight loss”. The total number of apps resulted from the search term “weight loss” are 500 apps. The most popular apps from the Australian iTunes App store were collected on 25 June 2014 from iTunes store. The top 30 popular apps that resulted from the search term “weight loss” were only considered to study the aforementioned inclusion criteria on them (see Appendix 1). The apps that met the previous inclusion criteria will be included in the analysis. Otherwise, the app would be excluded.

On 24 June 2014, the apps collected from the iTunes store by using the search term “diet”. The total number of apps resulted from the search term “diet” were 500 apps. The most popular apps for Australian iTunes App store were collected on 25 June 2014. The top 30 popular apps that resulted from the search term “diet” were the only ones considered to study the aforementioned inclusion criteria (see Appendix 2). The apps that met the inclusion criteria will be analysed, otherwise, the app will be excluded.

Although there are top 30 apps resulted from the search term “weight loss” (see Appendix 1), only 12 apps met the inclusion criteria of this study and hence they have been included in the analysis (see table 4.1). Two of the top 30 popular apps did not have any stars rating in the Australian iTunes Store and hence were excluded. The rest of the 16 apps have been excluded, as they did not meet one or more of the inclusion criteria of this study. While grey rows in Table 4.1 demonstrate the apps that have been excluded from the study, white rows demonstrate the apps that are included in the study.

**Table 4.1 Test top popular 30 apps that resulted from search term “weight loss” whether it meet the inclusion criteria or not**

<b>iTunes Selective Review 1- Test top popular 30 apps that resulted from search term “weight loss” if meet inclusion criteria</b>					
<b>App Name</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>Star Rating</b>
1. My Diet Coach ... (© 2012 InspiredApps)	X	X	X	X	4.5
2. Weight Loss (© ModiFace Inc.)	X	X	X	X	No rating
3. Lose Weight not lose mind ... (© atoz)	X	X	X	X	2.5
4. Jillian Michaels Slim-Down ... (©2013 everyday Health Inc.)	X	X	X	X	4
5. Walk with Map My Walk ... (© 2013, MapMyFitness, Inc.)	X	X	X	X	4.5
6. Lose the Belly ... (©2013 Pacific Spirit Media Inc.)	X	X	X	X	2
7. Weight Loss Hypnosis ... (©Surf City Apps LLC)	X	X	X	X	4.5
8. Weight Loss Hypnosis by Mindifi ... (©Mindifi)	X	X	X	X	4
9. Best Diet Foods! ... (© 2014 Michael Quach)	X	X	X	X	2.5
10. Easy Weight Loss Tips! ... (© 2013 Michael Quach)	X	X	X	X	2.5
11. Calorie Counter & Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)	X	X	X	X	4.5
12. Nutricise-Meal Planner & Weight Loss Programs (©2013 Nutricise Pty Ltd)	X	X	X	X	4.5
13. MyFit Fitness ... (©MyFit Fitness Inc)	X	X	X	X	3.5
14. Weight Loss! (©Zky)	X	X	X	X	1.5
15. Weight Watchers Mobile AU (©2013 Weight Watchers International Inc.)	X	X	X	X	3.5
16. Healthy Recipes ... (©2010 Pacific Spirit Media 2010)	X	X	X	X	2
17. Nexercise ... (© 2014 Nexercise Inc.)	X	X	X	X	4.5
18. TactioHealth ... (©2011-2014 Tactio Health Group Inc. )	X	X	X	X	4
19. Happy Scale: Simple Weight Loss Tracker ... (© Front Pocket Software LLC)	X	X	X	X	4
20. Walkmeter GPS Pedometer ... (©2014 Abvio Inc.)	X	X	X	X	4.5
21. Diet Shakes ... (©2011-2012 Our3Wishes)	X	X	X	X	2
22. Virtual Weight Loss Model Lite (©2009 Pacific Spirit Media Inc.)	X	X	X	X	2
23. Weight Loss for Men ... (©2013 Pacific Spirit Media Inc.)	X	X	X	X	2
24. Diet Tips Free! ... (©2014 Michael Quach)	X	X	X	X	3
25. Walk with Map My Walk ... (© 2013, MapMyFitness, Inc.)		X	X	X	5
26. Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss (©2012-2013 Clear Sky Apps Ltd)	X	X	X	X	4.5
27. Situps 0 to 200: sit ups Workout Trainer, Abs exercise pro to help weight loss (©2012-2013 Clear Sky Apps Ltd)		X	X	X	5
28. Your Ideal Weight ... (©MOVISOL Media S.L.)	X	X	X	X	2.5
29. Lose Weight with FitFrnd ... (©2012 Durga P Pandey)	X	X	X	X	2.5
30. Diet Buzz ... (©Joe Sriver)	X	X	X	X	No rating

Likewise, the top 30 popular apps from the search term “diet” were identified. 19 apps were included in the analysis as they met the inclusion criteria of this study. However, 11 apps have been excluded, as they did not meet one or more of the inclusion criteria. Grey rows in Table 4.2 demonstrate the apps that have been excluded from the study and white ones demonstrate the apps that are included in the study.

**Table 4.2 Test top popular 30 apps that resulted from search term “diet” if meet the inclusion criteria or no**

<b>iTunes Selective Review 2- Test top popular 30 apps that resulted from the search term “diet” if meet inclusion criteria</b>					
<b>App Name</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>Star Rating</b>
1. Calorie Counter & Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)	X	X	X	X	4.5
2. My Diet Coach – Weight Loss for Women (© 2012 InspiredApps)	X	X	X	X	4.5
3. Low Fat Recipes- Diet, Lose Fat, Lose Weight (© AC)	X	X	X	X	4
4. Australian Calorie Counter- Easy Diet Diary (© 2013 Xyris Holdings Pty Ltd)	X	X	X	X	4.5
5. Your Ideal Weight: Calculator for your losing diet (© MOVISOL Media S.L)	X	X	X	X	2.5
6. Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution (©2013 EveryDay Health Inc.)	X	X	X	X	4
7. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss (© 2013, MapMyFitness, Inc.)	X	X	X	X	4.5
8. MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health (© LIVESTRONG.COM)	X	X	X	X	4.5
9. Best Diet Foods! Weight Loss Food Tips For Easy Healthy Eating (© 2014 Michael Quach)	X	X	X	X	2.5
10. My Diet Diary- Your Personal Calorie Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking (© 2012-2014 MedHelp)	X	X	X	X	4
11. Calorie Counter and Diet Tracker by Calorie Count (© 2012 About, Inc.)	X	X	X	X	4
12. Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... (©Surf City Apps LLC)	X	X	X	X	4.5
13. Easy Weight Loss Tips! Best Diet Tracker & Mobile Diet Plan (© 2013 Michael Quach)	X	X	X	X	2.5
14. I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet (© 2013 I feel Good Pty Ltd)	X	X	X	X	4
15. Belly Fat Workout Free-10 Minute Ab Exercises (©procodemedia.com 2012)	X	X	X	X	4
16. FatBooth (©2010-2013 PiVi & Co)	X	X	X		4
17. Weight Watchers Mobile AU (©2013 Weight Watchers International Inc.)	X	X	X	X	3.5
18. Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter (© 2014 MapMyFitness Inc)	X	X	X	X	5
19. Seven Day Diet (© Techfu)		X	X	X	2
20. Happy Scale: Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log... (© Front Pocket Software LLC)	X	X	X	X	4

<b>iTunes Selective Review 2-</b> Test top popular 30 apps that resulted from the search term “diet” if meet inclusion criteria					
<b>App Name</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>Star Rating</b>
21. CalorieKing Australia Food Search (© CalorieKing Wellness Solutions, Inc.)	X	X	X	X	4
22. Nutrition Quiz: 600+Facts, Myths & Diet Tips for Healthy Living (©2013 runtastic GmbH)	X	X	X	X	4.5
23. Diet Shakes- For fat burning & weight loss that builds lean muscle (©2011-2012 Our3Wishes)	X	X	X	X	2
24. Fatify- Get fat (© Apptly LLC)	X	X	X		4
25. Diet Tips Free! Best Diet Tracker App, Beauty Diet Plans, Easy Weight Loss For Women & Men (©2014Michael Quach)	X	X	X	X	3
26. Fitbit (© 2014 Fitbit, Inc.)	X	X	X	X	4
27. Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)	X	X	X	X	4.5
28. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss \$3.79 (© 2013, MapMyFitness, Inc.)		X	X	X	5
29. Best Diet Foods- how to keep fit with diet (© zky)	X	X	X	X	4
30. The Monash University Low FODMAP Diet (© 2012 Monash University)		X	X	X	4.5

### Repeated Apps That Resulted From The Search Terms “Weight Loss” And “Diet”

Repeated apps are the apps that appeared in the apps’ results page even though different search terms have been used. In iTunes store, repeated apps were present in the search for weight loss apps and appeared again in the search for diet apps. iTunes repeated apps resulted from the search terms “diet” and “weight loss” are presented in the table 4.3:

**Table 4.3 Repeated iTunes Apps that resulted from the search terms “diet” and “weight loss”**

	App Name	Developer
1.	My Diet Coach – Weight Loss for Women	InspiredApps
2.	Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution	EveryDay Health Inc.
3.	Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss	MapMyFitness, Inc.
4.	Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast...	Surf City Apps LLC
5.	Best Diet Foods! Weight Loss Food Tips For Easy Healthy Eating	Michael Quach
6.	Easy Weight Loss Tips! Best Diet Tracker & Mobile Diet Plan	Michael Quach
7.	Calorie Counter & Diet Tracker by MyFitnessPal	MyFitnessPal Inc.
8.	Weight Watchers Mobile AU	Weight Watchers International Inc.
9.	Happy Scale: Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log...	Front Pocket Software LLC
10.	Diet Shakes- For fat burning & weight loss that builds lean muscle	Our3Wishes
11.	Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss \$3.79	MapMyFitness, Inc.
12.	Diet Tips Free! Best Diet Tracker App, Beauty Diet Plans, Easy Weight Loss For Women & Men	Michael Quach
13.	Your Ideal Weight: Calculator for your losing diet	MOVISOL Media S.L

The total number of top popular apps resulted from both search terms, which met the inclusion criteria were 31 apps. However, the apps reduced from 31 to 25, as there were six repeated apps that met the inclusion criteria. This reduction is necessary to overcome the duplication of apps. The rest of the repeated apps did not meet the inclusion criteria. The six repeated apps were as follow:

1. My Diet Coach – Weight Loss for Women by InspiredApps,
2. Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution by EveryDay Health Inc.,
3. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss by MapMyFitness, Inc.,
4. Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... by Surf City Apps LLC,
5. Calorie Counter & Diet Tracker by MyFitnessPal by MyFitnessPal Inc.,
6. Happy Scale: Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log by Front Pocket Software LLC.

### *Included Apps*

The total number of Australian iTunes top 30 popular apps that resulted from the search terms “weight loss” and “diet” that included in the analysis was 25 apps out of the possible 60 apps.

### *Excluded Apps*

The total number of Australian iTunes top 30 popular apps that resulted from the search terms “weight loss” and “diet” that were excluded from the analysis was 29 apps out of the possible 60 apps. Six apps were excluded because of duplication within the two search terms.

## **4.3 SELECTIVE REVIEW OF APPS FROM AUSTRALIAN ANDROID MARKET (GOOGLE PLAY)**

This section describes the second components of stage one- **Identifying Apps**, which included the selective review of apps that were located in the Google Play market.

The process of identifying apps from the Google Play market commenced by typing specific key terms as search queries in the Google Play search engine. The key terms were “weight loss”, and “diet”.

The selective review of Google Play apps underwent the same inclusion criteria previously considered in the selective review of the iTunes apps (see section 4.2).

The results of the selective review of Google Play apps enabled stage three- **Application of the framework** later in this study.

### **4.3.1 Characteristic of Google Play Market Search Engine**

The search terms were entered in a number of ways in the Google Play search engine (e.g. “weight loss”, “WEIGHT LOSS”, “Weight loss”, and “Weight Loss”) and the results were the same. Hence, the Google Play search engine is not case sensitive. For example, using “Diet” or “diet” produced exactly the same results. Likewise, using “weight loss” or “Weight Loss” produced also the same results. This research used “weight loss” and “diet” search terms for identifying Google Play apps.

### **4.3.2 Developing a Scale for Identifying the Top Popular Apps in the Google Play Store**

A scale was developed to identify the top popular Google Play apps. The inclusion criteria for this study involve considering the top popular apps. However, unlike iTunes, Google Play does not rank apps according to their popularity. However, it does provide the total number of downloads for each app in ranges such as 100-500, 500-1000 and so on. All of the possible ranges number of downloads in Google Play have been identified (Appendix 5). To find the top popular apps in the Google Play store, all apps that resulted from the search terms “weight loss” and “diet” have been typed in rows in two separate Excel spread sheets in the same order as they appear in the store. Next, the frequency of downloads that Google Play store provides for each of the 250 weight loss apps and the 250 diet apps resulted from the search have been gathered and typed in another column. Utilising the Excel function =COUNTIF, allows counting the number of apps within a certain download range. The next step was to manually classify and arrange the apps based on their frequency of downloads. The top 30 popular apps are the apps that have been most frequently downloaded. Thus, to identify the top 30 popular apps in the Google Play store, a download range scale for measuring the download popularity of apps has been developed.

As a result of the developed scale, and due to the selected apps having high downloads, the top popular apps categories have expanded for both search terms. To illustrate, the number of the top popular apps resulted from the search term “weight loss” are 35 apps and not 30 apps (Appendix 6). Also, the diet top popular apps have been extended to 32 apps (Appendix 7). It was not possible to exactly choose 30 top popular apps, as there were a number of apps that had the same category of download. Choosing one of these top popular apps that had the same range of downloads and disregarding another with the same range of downloads, would cause an inconsistency. Thus, all of the top popular apps located under the same range of downloads have been included in the analysis.

To illustrate, the following “weight loss” apps were included in this study within the top popular ~30 apps: One app was located in the range of 10,000,000-50,000,000. Another app was located in the range of 5,000,000 - 10,000,000. Four additional apps were under the 1,000,000-5,000,000 category. Seven apps were located within the range

of 500,000-1,000,000 and 22 apps located within 100,000-500,000. The total number of these apps is 35 apps. None of the apps located in the range of 100,000-500,000 were excluded as all the apps had the same range of downloads. For this reason, the top 30 popular “weight loss” apps groups from the Google Play store have been expanded. Also, the “diet” top popular apps have been extended to 32 apps for the same reason (Appendix 7).

### **4.3.3 Number of Google Play Apps Resulted From “Weight Loss” & “Diet” and the Top Popular Apps**

The total number of apps from the Google Play as a result of the search terms “weight loss” and “diet” were 500 apps. However, the restriction of the available resources for this study has limited this research to the number of apps included in the analysis. Thus, this study only focuses on the top 30 popular apps.

First, the apps were collected from the Google Play market on 26 to 30 June 2014 by using the search term “weight loss”. The total number of apps resulted from the search term “weight loss” were 250 apps (Appendix 3). The download popularity of Google Play apps were identified by using the scale developed for measuring the download popularity (see section 4.3.2). The total number of top popular apps as a result of the search term “weight loss” was 35 apps. The results were 35 apps and not 30 apps as mentioned previously in section 4.3.2 because Google Play does not arrange apps in accordance with their downloads popularity like iTunes, rather they provides the number of downloads in ranges. The top 35 popular apps were only considered to examine the aforementioned inclusion criteria on them. Grey rows in Table 4.4 below demonstrate the apps that were excluded from this study and white ones show the apps that were included in this study.



**Table 4.4 Test top popular Google Play apps that resulted from the search term “weight loss” if meet the inclusion criteria or no**

<b>Android Selective Review 1- Test top popular Google Play apps that resulted from the search term “weight loss” if meet the inclusion criteria or no</b>						
<b>App Name</b>	<b>Downloads</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>Star Rating</b>
Noom Weight Loss Coach	10,000,000 - 50,000,000	X	X	X	X	4.3
BMI Calculator -Weight Loss-smayer.net	5,000,000 - 10,000,000	X	X	X	X	4
Diet Assistant - Weight Loss	1,000,000 - 5,000,000	X	X	X	X	4
My Diet Coach - Weight Loss	1,000,000 - 5,000,000	X	X	X	X	4.3
Diet Point · Weight Loss	1,000,000 - 5,000,000	X	X	X	X	4.3
Weight Tracker weight loss app	1,000,000 - 5,000,000	X	X	X	X	3.9
Monitor Your Weight	500,000 - 1,000,000	X	X	X	X	4.4
Nexercise = fun weight loss	500,000 - 1,000,000	X	X	X	X	4.5
Weight Loss Tracker - RecStyle	500,000 - 1,000,000	X	X	X	X	4.3
BMI Calculator - Weight Loss -prez	500,000 - 1,000,000	X	X	X	X	4.2
Simple Weight Recorder	500,000 - 1,000,000	X	X	X	X	4.3
Diets for losing weight	500,000 - 1,000,000	X	X	X	X	4
DietCalendar Free (weight)	500,000 - 1,000,000	X	X	X	X	3.7
Effective Weight Loss Guide	100,000 - 500,000	X	X	X	X	4.1
43 Best Foods for Weight Loss	100,000 - 500,000	X	X	X	X	3.8
Weight Loss Diet Plan	100,000 - 500,000	X	X	X	X	3.8
101 Weight Loss Tips	100,000 - 500,000	X	X	X	X	3.7
Weight Loss Tracker	100,000 - 500,000	X	X	X	X	3.8
Fitocracy Workout Fitness Log	100,000 - 500,000	X	X	X	X	3.5
Simple Weight Loss Resolution	100,000 - 500,000	X	X	X	X	3.6
Easy Weight Loss	100,000 - 500,000	X	X	X	X	3.4
Yoga for Weight Loss I (PRO)	100,000 - 500,000	X	X	X	X	3.7
Valentine's Weight Loss	100,000 - 500,000	X	X	X	X	4
Weight Loss & Healthy Foods	100,000 - 500,000	X	X	X	X	4
10 Best Weight Loss Diet Plans	100,000 - 500,000	X	X	X	X	4
Yoga for Weight Loss II (PRO)	100,000 - 500,000	X	X	X	X	3.8
Weight control	100,000 - 500,000	X	X	X	X	4.1
Weight War	100,000 - 500,000	X	X	X	X	4.7
Weight Diary	100,000 - 500,000	X	X	X	X	4.2
Ideal weight	100,000 - 500,000	X	X	X	X	3.2
Weight Tracker	100,000 - 500,000	X	X	X	X	3.5
How to lose weight	100,000 - 500,000	X	X	X	X	3.7
How To Lose Weight Fast	100,000 - 500,000	X	X	X	X	3.7
Weight Track Assistant	100,000 - 500,000	X	X	X	X	4.1
How To Lose Weight Quickly	100,000 - 500,000	X	X	X	X	3.6

Second, the apps were collected from the Google Play market on 1 July 2014 by using the search term “diet”. The total number of apps resulted from the search term “diet” were 250 apps (Appendix 4). The developed scale for measuring the download

popularity identified the most downloaded apps for Google Play (see section 4.3.2). The total number of top popular apps resulted from the search term “diet” were 32 apps. The results were 32 apps and not 30 apps as planned (see section 4.3.2) because Google Play does not rank their apps based on downloads popularity, however identifying the top popular apps depend on the developed scale of downloads popularity. The top 32 popular apps were the only apps considered for study using the aforementioned inclusion criteria on them out of the possible 250 apps. Grey rows in Table 4.5 indicate the apps that were excluded from the study and white ones demonstrate the apps that were included.

**Table 4.5 Test top popular Google Play apps that resulted from the search term “diet” if meet the inclusion criteria or no**

<b>Android Selective Review 2- Test top popular Google Play apps that resulted from the search term “diet” if meet the inclusion criteria or no</b>						
<b>App Name</b>	<b>Downloads</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>Stars Rating</b>
Calorie Counter – MyFitnessPal	10,000,000 – 50,000,000	X	X	X	X	4.7
My Diet Coach – Weight Loss	1,000,000 – 5,000,000	X	X	X	X	4.3
Diet Assistant – Weight Loss	1,000,000 – 5,000,000	X	X	X	X	4
My Diet Diary Calorie Counter	1,000,000 – 5,000,000	X	X	X	X	4.2
Diet Point · Weight Loss	1,000,000 - 5,000,000	X	X	X	X	4.3
Woman's DIARY period · diet · cal	1,000,000 - 5,000,000	X	X	X		4.1
Diets for losing weight	500,000 - 1,000,000	X		X	X	4
OneStep Diet	500,000 - 1,000,000	X		X	X	3.2
The 90 Day Diet	100,000 - 500,000	X	X	X	X	3.4
Diet Plan	100,000 - 500,000	X	X	X	X	4.2
Diet Diary (Diet Calendar)	100,000 - 500,000	X	X	X	X	4.6
Weight Loss Diet Plan	100,000 - 500,000	X	X	X	X	3.8
Atkins Carb Tracker	100,000 - 500,000	X	X	X	X	3
Calorie Counter PRO MyNetDiary	100,000 - 500,000		X	X	X	4.5
Photo diet	100,000 - 500,000	X	X	X	X	4
Paleo Diets & Recipes	100,000 - 500,000	X	X	X	X	3.9
Diet Pedometer	100,000 - 500,000	X	X	X	X	3.2
South Beach Diet	100,000 - 500,000	X	X	X	X	3.3
Pedometer Walking Diet	100,000 - 500,000	X	X	X	X	3.3
M-Diet Helper	100,000 - 500,000	X		X	X	4.6
my Diet Journal	100,000 - 500,000	X	X	X	X	4.1
Diet Camera	100,000 - 500,000	X	X	X	X	2.7
Diet Watcher Cookbook	100,000 - 500,000	X	X	X	X	2.9
100 days Diet	100,000 - 500,000	X		X	X	4
Chien Binh Diet Quy	100,000 - 500,000	X		X		4
DietShin-diet 청혈주스 레시피	100,000 - 500,000	X		X	X	4.3
3 Day Easy Diet app	100,000 - 500,000	X	X	X	X	3.6
Manage your weight and diet	100,000 - 500,000	X		X	X	4.1
10 Best Weight Loss Diet Plans	100,000 - 500,000	X	X	X	X	3.5
Point by Point - Diet Lite	100,000 - 500,000	X	X	X	X	4.1
4F Diet Exercises & Fitness	100,000 - 500,000	X	X	X	X	3.6
Calorie Counter & Diet Tracker	100,000 - 500,000	X	X	X	X	4.2

The total number of top popular apps as a result of the search terms “weight loss” and “diet” were 67. However, from the top 35 popular apps resulted from the search term “weight loss”, only 19 apps met the inclusion criteria of this study and 16 apps did not meet one or more than one of the inclusion criteria for this study. Thus, these 16 apps were excluded.

From the top 32 popular apps resulted from the search term “Diet”, only 10 apps met the inclusion criteria for this study. The remaining 22 apps did not meet one or more of the inclusion criteria for this study and hence were excluded.

### **Repeated Apps that Resulted from the Search Terms “Weight Loss” & “Diet”**

Repeated apps are the apps that appeared in the apps’ results page even though different search terms have been used. In this case, repeated apps were the apps that appeared in the weight loss search and appeared again under the diet search. There are 6 apps repeated out of the possible 67 apps. Table 4.6 shows these repeated apps.

**Table 4.6 Google Play repeated top popular Apps resulted from the search terms “diet” and “weight loss”**

	<b>App Name</b>	<b>Developer</b>
1.	Diet Assistant - Weight Loss	Alportela Labs
2.	My Diet Coach - Weight Loss	InspiredApps (A.L) LTD
3.	Diet Point · Weight Loss	DietPoint Ltd.
4.	Diets for losing weight	STR LABS
5.	Weight Loss Diet Plan	Health Club
6.	10 Best Weight Loss Diet Plans	Insplisity

As result of this repetition in apps from both search terms, the number of apps were reduced from 29 to 26 as three of those apps met the inclusion criteria namely (1) Diet Assistant - Weight Loss by Alportela Labs, (2) My Diet Coach - Weight Loss by InspiredApps (A.L) LTD, and (3) Diet Point · Weight Loss by DietPoint Ltd. The rest of the repeated apps did not meet the inclusion criteria.

### **Included Apps**

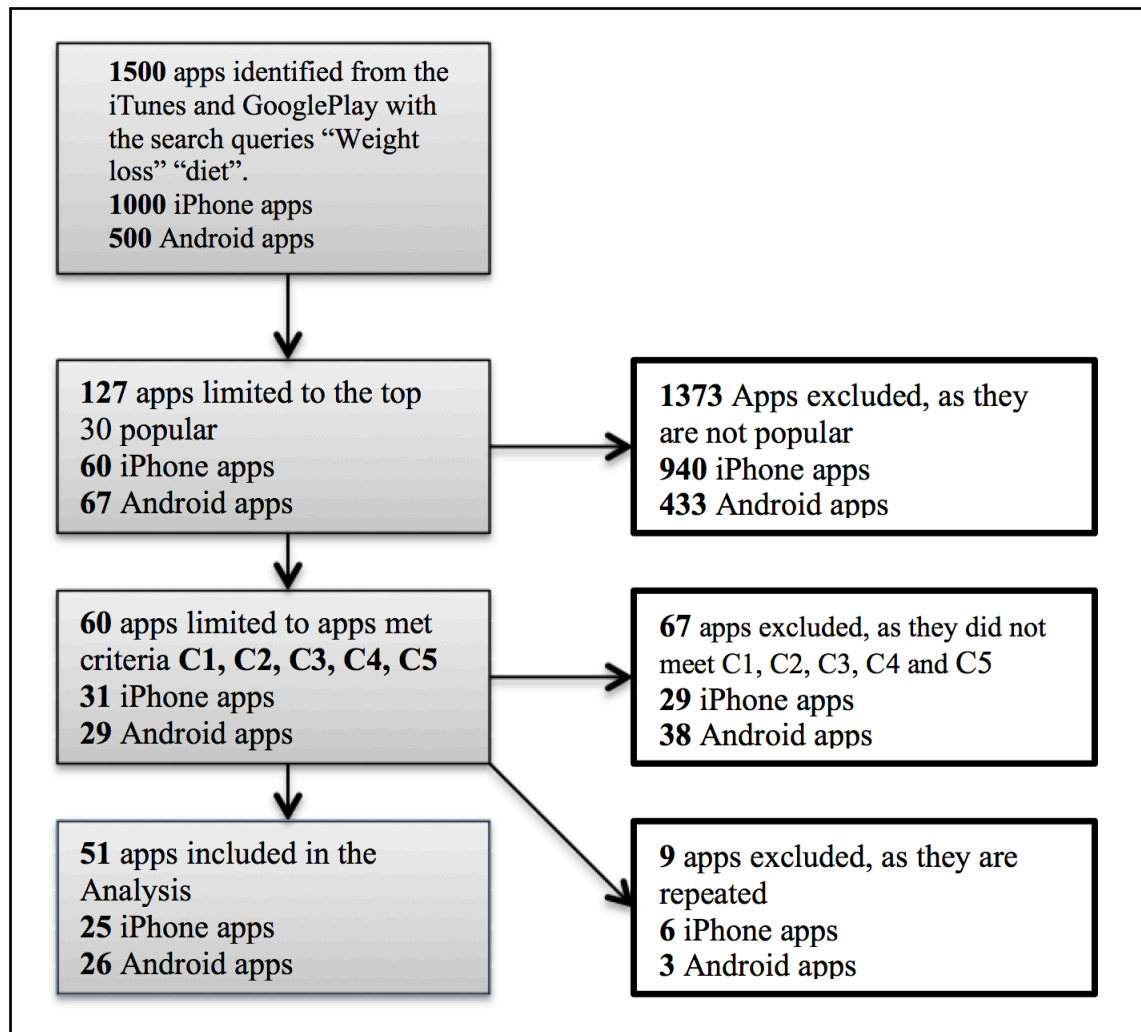
The total number of the Australian Google Play top popular apps that resulted from the search terms “weight loss” and “diet” that were included in the analysis were 26 apps out of a possible 67 apps.

### Excluded Apps

The total number of Google Play top popular apps that resulted from the search terms “weight loss” and “diet” that were excluded from the analysis were 38 apps out of a possible 67 apps. Three other apps were excluded because of duplication.

## 4.4 INITIAL FINDINGS

Figure 4.1 Shows the results of Apps selective review process



- Initial Finding 1:** Some apps in the Australian Google Play market such as “Woman's DIARY period • diet • cal” by HighLab Co.,Ltd. were excluded from the analysis as they were not mainly related to weight loss or diet. It includes feature of tracking weight, but the app is mainly related to woman's diary period. The search engine should not retrieve apps based on the key terms in the title of apps only. Some other factors such as the main function of the app should be

considered in retrieving apps to customers. Likewise, in the Australian iTunes store, the following two apps did not relate to weight loss FatBooth by PiVi & Co and. Fatify- Get fat by Apptly LLC. They were displayed as results of the search terms “weight loss” and “diet”. Apparently, iTunes search engine has considered the term “fat” to include these apps within the apps that relate to weight loss and diet.

- **Initial Finding 2:** Google Play store should consider the country of their customers. Although this study was performed on the Australian Google Play store many apps in language other than English were displayed as result of the search terms “diet” and “weight loss”. For example, “Diets for losing weight” by STR LABS and “OneStep Diet” by NHK ENTERPRISES, INC. are not in the English language. Likewise, the following displayed apps are not in English: Diets for losing weight, OneStep Diet, M-Diet Helper, 100 days Diet, Chien Binh Diet Quy, Manage your weight and diet, and DietShin-diet 청혈주스 레시피.
- **Initial Finding 3:** In Google Play, some apps were the same and had been developed by the same developer but they appeared in different names. For example, “How To Lose Weight Quickly” and “How To Lose Weight Fast” by Venture Technology Ltd do have exactly the same content. One issue of the duplicated apps that appears under different names in the store could be that users might download both of them while they only need to download one of them. This issue is potentially more serious when the apps are not free. Thus, there is a need to develop a smarter way of retrieving apps for the Google Play search engine. Apps that have the same contents and different display names such as “How To Lose Weight Quickly” and “How To Lose Weight Fast” should not be retrieved at the same time to a user who entered a specific search term.

### 4.5 CHAPTER REFLECTION

Chapter four has described the process of the selective review of apps from the Australian iTunes store and Australian Google Play market and presented the results of the review. The chapter briefly has discussed some of the limitations that result in the exclusions of some of the apps.

Next Chapter will show the data analysis of phase two, its discussion and interpretation.

Chapter Five  
Data Analysis, Discussion  
and Interpretation of  
Development of Evaluation  
Framework  
Phase Two

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## 5. DATA ANALYSIS, DISCUSSION AND INTERPRETATION OF DEVELOPMENT OF EVALUATION FRAMEWORK-PHASE TWO

### 5.1 INTRODUCTION

This chapter presents outcomes of analysing the literature to develop the weight loss/ diet evaluation framework. As previously described in the methodology chapter (section 3.6.2 and 3.7.1), the **Development of the Evaluation Framework- phase two**, utilised a content analysis of the literature to identify the proper method of evaluating apps. The literature has been also analysed to assist in the evaluation of a suitable framework, which includes elements that enable evaluation of the weight loss/diet apps to assist in answering the research question. This chapter involves the following sections:

- Section 5.2 demonstrates the available methods of evaluating wellness-monitoring apps. The analysis of the literature has revealed that there were two main methods of evaluating weight loss/diet apps. The first method is the Harrison et al.'s (2013) method, which evaluates apps' attributes in terms of effectiveness, efficiency, satisfaction, learnability, memorability, errors, and cognitive loads. The second method is Breton et al. (2011) method. A more detailed interpretation and discussion of these evaluation methods is presented in this section. The second method is more appropriate for the current research and hence has been used here.
- Section 5.3 presents the elements of evaluating weight loss/diet apps in Breton et al. (2011), Azar et al. (2013) and IMS (2013) studies. It also demonstrates behavioural weight loss strategies. This section shows the selected elements of the evaluation framework used for this research. The proposed evaluation framework included elements related to the usability and the design of apps. The usability elements of the framework for this research were built on the common elements from Breton et al. (2011), Azar et al. (2013), IMS (2013), and behavioural weight loss strategies. Furthermore, the design elements were based on Alagöz et al. (2010) design strategies. The last element of the evaluation framework was the index score, which scores apps in relation to their usability and design elements. This section interprets and discusses the proper elements used for the evaluation framework.



## **5.2 METHOD OF THE EVALUATION FRAMEWORK**

This section presents the identified methods of evaluating smartphones' wellness apps that resulted from analysing the available literature by the qualitative content analysis (see section 3.6.2 and 3.7.1).

As previously mentioned in chapter two (section 2.4 and 2.4.2), the two main methods for evaluating wellness smartphones' apps have been identified. Firstly, Harrison et al. (2013) have evaluated apps according to the PACMAD (People At the Centre of Mobile Application Development) model. This model evaluates the following elements: effectiveness, efficiency, satisfaction, learnability, memorability, errors, and cognitive loads. In addition, it considers three main factors: user, task, and context (Harrison et al. 2013). Each of these elements has its own utility assessed. The PACMAD model is a comprehensive model, which can evaluate apps based on these several general elements. According to Harrison et al. (2013),

*“PACMAD model brings together significant attributes from different usability models in order to create a more comprehensive model”* (Harrison et al, 2013, p.1).

The authors claim that although none of the elements of the PACMAD model is new, the existing prominently available usability models disregard some of these elements. This leads to an inaccurate evaluation of smartphones' apps usability (Harrison et al. 2013). However, evaluating large number of apps using the PACMAD model requires extensive resources including time and participants. Thus, apps cannot be evaluated using the PACMAD model within this research project. To illustrate how this model requires extensive resources, consider effectiveness, one of the usability elements of PACMAD model. According to Harrison et al. (2013),

*“effectiveness is measured by evaluating whether or not participants can complete a set of specified tasks”* (Harrison et al, 2013. p.4).

As this research aims (see Chapter 3, section 3.2.1) to identify the most popular weight loss and diet apps according to specific criteria and evaluation framework, it would be time consuming to evaluate the effectiveness of each app in the aforementioned way. This research has identified 51 Google Play and iTunes apps (see

chapter, section 4.2, 4.3 and 4.4) which is a large number of apps to be individually evaluated.

Some of the PACMAD model elements need extensive time to evaluate such as the learnability element. According to Harrison et al. (2013),

*“In order to measure Learnability, researchers may look at the performance of participants during a series of tasks, and measure how long it takes these participants to reach a pre-specified level of proficiency”* (Harrison et al, 2013, P.4).

Measuring the learnability element for each of the 51 apps would be time and resource consuming which exceeds the available resources for this research.

Some of the PACMAD model elements are difficult to evaluate such as measuring memorability of an app.

*“There is difficulty associated with evaluating Memorability”* (Harrison et al. 2013, p.10).

Measuring memorability requires examining participants’ use of apps after a period of inactivity with it. There is a real issue in recruiting participants who are willing to return a multiple of times to participate in an evaluation (Harrison et al. 2013). Thus, evaluating a large number of apps would be time and resource intensive and so exceed the available resources for this research.

By analysing the literature, another method of evaluating wellness apps was identified. There are several studies such as Breton et al. (2011), Azar et al. (2013), IMS (2013), and Abroms et al. (2013) that have evaluated wellness apps by firstly identifying predefined usability elements. For example, in Breton et al. (2011), Azar et al. (2013), the elements were related to weight loss and diet. Then, the apps were evaluated according to the presence or absence of these usability elements in the apps. However, in the study of Abroms et al. (2013), the elements were related to smoking cessation. Each of these studies has developed its scoring system for evaluating apps. To illustrate, Breton et al. (2011) examined the contents of each apps based on the 13 pre-defined weight loss related elements (see Chapter 2, section 2.4.3). If the elements were present in the app, the app then would take a certain score. Then, the app scores of

all 13 elements are calculated and the total score is obtained as an index score for the app. By evaluating several apps based on specified usability elements, each app should have its own index score. The apps can be then ranked according to their index scores.

The presence and absence of the elements could be represented in different ways. It could be represented as numbers such as in the studies of IMS Institute for healthcare informatics (2013) and Abroms et al. (2013). For instance, in Abroms et al. study each item was coded as 0 which indicates, “not present at all”, 1 indicates “partially present”, or 2 which indicates that the element is “fully present”. It could also be coded as yes=1 or no=2 as in the Azar et al. (2013) study or by denoting “X” which means x=1 as in Breton et al.s’ (2011) study.

The second way of evaluating apps is more appropriate for this study as the elements of PACMAD model are general in its nature; hence it might be less efficient if applied to determine the efficacy of weight loss and diet apps. In addition, as previously discussed in this chapter (section 5.2), applying the PACMAD model for large number of apps exceeds the resources available to this research. Thus, Breton et al. (2011) method of evaluating apps was followed here.

Section 5.2 has presented the available methods of evaluating wellness apps in the recent available literature. The next section will discuss the elements of the evaluation frameworks.

### 5.3 ELEMENTS OF THE EVALUATION

Section 5.2 discussed the suitable methods of evaluating wellness apps according to the method of Breton et al. (2011). This section presents the elements of evaluating weight loss/diet apps for each of Breton et al. (2011), Azar et al. (2013), and IMS (2013). This section also demonstrates the behavioural weight loss strategies. The final elements selected for the evaluation framework are given. The proposed evaluation framework included elements related to the usability and design of apps. The usability elements for weight loss/diet apps evaluation framework for this research were based on the common elements gained from Breton et al. (2011), Azar et al. (2013), IMS (2013), and behavioural weight loss strategies. Whereas the design elements were based on Alagöz et al. (2010) wellness apps design strategies. This section also interprets and discusses the suitable elements for the evaluation framework.

### **5.3.1 Usability Elements**

As previously mentioned, the evaluation elements of the suggested evaluation framework for this research were based upon an analysis of the literature (see chapter 3, section 3.7.2 and 3.8.1). The suggested evaluation elements of the evaluation framework were divided into two main parts. Firstly, the usability elements that concern with the functionality of the apps. These elements were included as the available literature revealed that they were common elements in the following weight loss/diet evaluation frameworks Breton et al. (2011), Azar et al. (2013), IMS (2013), or they were one of the behavioural weight loss strategies in Pagoto et al. (2013). The following sections detail the evaluation elements for each of these studies.

#### **Breton et al. (2011) Evaluation Elements**

The Breton et al. (2011) evaluation framework for weight-loss monitoring applications includes assessment of 13 elements. Breton et al. (2011) elements were based upon evidence-informed practices that were common to all of the following governmental agencies: the Centers for Disease Control and Prevention, National Institutes of Health, the Food and Drug Administration, and the US Department of Agriculture. The following thirteen elements were used to investigate the usability of apps:

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**Breton et al.'s (2011) evaluation framework Elements**

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<b>1</b>	Does the app calculate users weight
<b>2</b>	Does the app give a recommendation on a certain number of daily serving of vegetables and fruits
<b>3</b>	Does the app suggest a certain amount of physical activity each day/week
<b>4</b>	Does the app suggest a certain number of daily servings of water or enable users to track their daily servings of water
<b>5</b>	Does the app have a food diary
<b>6</b>	Does the app allow users to calculate the number of calories needed in order to meet desired weight loss/maintenance goals given one's activity level
<b>7</b>	Does the app suggest weight loss goals of 1 to 2 lb/week
<b>8</b>	Does the app describe or illustrate portion sizes
<b>9</b>	Does the app suggest reading labels, describe how to properly read labels, or permit users to look up nutritional information for food items
<b>10</b>	Does the app provide a means to track weight over time
<b>11</b>	Does the app provide a means to track daily physical activity
<b>12</b>	Does the app recommend users plan their meals, have a tool for menu planning, or a way to search recipes
<b>13</b>	Does the app enable users access to social support components like message boards, chat rooms

Adopted from Breton et al (2011).

These aforementioned elements have been considered in deciding on the usability elements for the suggested weight loss/ diet apps evaluation framework. Breton et al. (2011) evaluation framework was a specific evaluation framework that merely evaluates weight loss and diet apps.

### **Azar et al. (2013) Evaluation Elements**

The Azar et al. (2013) evaluation elements for diet/nutrition and anthropometric tracking apps are based on the incorporation of features consistent with theories of behaviour change. The following are Azar et al. (2013) evaluation elements:

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Azar et al.'s (2013) evaluation framework Elements

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1	Knowledge (includes general information)
2	Cognitive strategies (includes perceived benefits, perceived barriers, perceived risks, self-efficacy, self-talk, perceived social norms)
3	Behavior strategies (includes Self-monitoring, Realistic goal-setting, Time management, Stimulus control, Self-reward, Social support, Modeling/vicarious learning, and Relapse prevention)
4	Emotion- focused strategies (Stress management, Negative affect management)
5	Therapeutic interventions (Skill-building/overview, Increasing knowledge, Motivational readiness)
6	Motivators (social praise, financial incentives, nonfinancial incentives)
7	Features that decreased barriers, such as tailored information
8	Triggers to promote continued use of the app (positive feedback for short- term task completion or automatic reminders/cues to use the app)

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Adopted from Azar et al. (2013)

Azar et al. (2013) claim that engaging a tool called “persuasive technology content survey” adopted from Fogg Behavioral Model (FBM) is required because traditional behavioral theories may not address the adaptive and persuasive nature of new technologies. Thus, the apps were scored on presence or absence of FBM main components. The following are the elements of the FBM: (1) motivators that involves social praise, financial incentives, and nonfinancial incentives; (2) features that decreased barriers, like tailored information; and (3) triggers to promote continued use of the app such as positive feedback for short-term task completion or automatic reminders/cues to use the app (Azar et al. 2013). All Azar et al.'s evaluation elements have been used in helping decide upon the common elements between the four different studies. Azar et al.'s evaluation elements were more general comparing with Breton et al. (2011). However, Azar et al.'s evaluation elements were still for diet/nutrition and anthropometric tracking apps.

### **IMS Institute for healthcare informatics (2013) Evaluation Elements**

The IMS (2013) conducted a study that aimed to evaluate healthcare apps available in the U.S. Apple Apps store; their framework included the following categories and attributes:

IMS Institute for healthcare informatics (2013) Evaluation Framework Elements	
<b>1</b>	Information (includes level of detail of information, provides information as text, provides information as picture, provides information as video, provides audio information)
<b>2</b>	Instruction (provides instructions to the user)
<b>3</b>	Tracking and guidance (includes ability to track and capture user entered data, graphically displays user entered data, outputs user data, can link to sensor, provides guidance based on entry)
<b>4</b>	Reminder (built in reminder function)
<b>5</b>	Communication (uses email, provides secure communication, provides link to social networks)
<b>6</b>	Use of phone functionality (use of phone's GPS, use of phone's camera, use of phone's scanner, use of phone's voice recorder) (IMS 2013)

Adopted from IMS Institute for healthcare informatics (2013)

These elements were taken into consideration when deciding on the common elements within the four studies. However, this framework was more general than Azar et al. (2013) and Breton et al. (2011) frameworks as it enables evaluation of all healthcare apps not only weight loss and diet apps.

### **Behavioral Weight Loss Strategies**

Pagoto et al. (2013) presented 20 behavioral weight loss strategies that were reflected in evidence based lifestyle interventions. These strategies have shown their effectiveness for weight control and reducing risk of blood disease and diabetes (Pagoto et al. 2013). The 20 strategies were also considered when deciding the common suitable elements for the suggested evaluation framework. Table 5.1 presents these 20 behavioral weight loss strategies:

**Table 5.1 The 20 Behavioural weight loss strategies**

<b>Strategy</b>	<b>Description</b>
<b>Weight-loss goal</b>	Participants are given a goal of 7%, or 1–2 pounds per week.
<b>Dietary goal</b>	Participants are given a fat and/or calorie goal that is consistent 90 with weight-loss goal.
<b>Calorie balance</b>	Participants learn how healthy eating and being active are 86.7 related.
<b>Physical activity goal</b>	Participants are encouraged to get 150 minutes of moderate- 20 intensity physical activities per week.
<b>Exercise safety</b>	Participants are instructed on how to measure exertion and avoid injury.
<b>Benefits of healthy diet and physical activity</b>	Participants learn of the health benefits of making lifestyle changes.

Strategy	Description
<b>Food substitutions</b>	Participants learn healthy substitutions for foods that are high in fat and calories.
<b>Food pyramid</b>	Review current food pyramid and its recommendations.
<b>Stimulus control</b>	Participants learn about food and activity cues and ways to change them.
<b>Portion control</b>	Participants learn to use scales, measuring cups, and spoons.
<b>Lifestyle activity</b>	Participants are encouraged to engage in lifestyle activities (e.g., parking further away).
<b>Target heart rate</b>	Participants are instructed on how to measure their target heart rate.
<b>Problem solving</b>	Participants learn a five-step process to brainstorm new solutions to problems that inhibit their progress.
<b>Stress reduction</b>	Participants learn how to prevent stress and cope with unavoidable stress.
<b>Relapse prevention</b>	Participants learn to identify what causes slips from healthy eating and being active and how to recover from them.
<b>Negative thinking</b>	Participants learn how to identify negative thoughts and talk back to them with positive ones.
<b>Social cues</b>	Participants learn how to identify problem social cues and add helpful ones.
<b>Develop regular pattern of eating</b>	Participants are instructed to eat three meals.
<b>Time management</b>	Participants learn strategies for fitting exercise into their schedules.
<b>Nutrition label reading</b>	Participants learn to read nutrition labels.

Adopted from (Pagoto et al. 2013, p. 578).

Pagoto et al. (2013) also identified seven technology-enhanced features that claimed to be directly relevant to an evidence-based strategy. These features include a barcode scanner; physical activity tracking device (e.g. accelerometer); online social network; reminders to eat a meal; tracking of negative thoughts/stress; a calendar; and flags for lapses in dietary goal adherence. These features have been considered in deciding between the common features in the four studies.

### Interpretation and Discussion of the Usability Elements

By analysing the literature, several usability elements were identified which can be used for evaluating weight loss apps. However, the following four elements that related to the functionality of weight loss/diet apps were included for this study, as they were the common elements within the three apps evaluation frameworks (Breton et al. 2011; Azar et al. 2013; IMS Institute for healthcare informatics 2013) or they were included in the weight loss behavioral strategies (Pagoto et al. 2013). As the selected four elements are shared between the aforementioned studies, they were considered to have a greater

need to be included than the other elements, which were only included once or twice in the previous studies. Thus, they have been included in the evaluation framework. The following are the included elements that related to app usability:

### **1. Ability of app to self-monitoring (*monitoring user data (weight)*):**

This element is concerned with checking whether the app provides a mean for tracking user's weight across a period of time. The app should allow the user to see the start weight and the end weight. In the evaluation of apps, the app was scored based on whether it provided a mean to track weight over time or not. This element was included as it was found in all of the following three studies:

Breton et al. (2011) included the weight-tracking feature in their weight loss/diet evaluation framework.

*“Track your weight scored on whether the app provided a means to track weight over time”* (Breton et al, 2011. p.224).

The concept of weight tracking was included in Azar et al. (2013) diet/nutrition and anthropometric evaluation framework.

*“Includes Self-monitoring”* (Azar et al. 2013, p.585).

Although Azar et al. (2013) only considering self-monitoring in a general way, the term self-monitoring was previously defined in section 2.2.2. Self-monitoring is where individuals utilise smart tools such as mobile apps or wearable sensors to collect, process, and visualise vast amount of personal data and assist individual monitoring and managing personal health factors (Paddock 2013). Thus, the “self-monitoring” term in Azar et al. study was considered as incorporated weight self-monitoring.

In addition, the evaluation framework for IMS 2013 has included the self-monitoring concept in their wellness evaluation framework.

*“Includes ability to track and capture user entered data”* (IMS 2013, p.54).

The wellness apps evaluation framework of the IMS (2013) concerns with the general health and did not focus on particular health aspects.

*“Ability to track and capture user entered data”*(IMS 2013, p.54)



This implies the ability to track user's weight. Therefore, the concept of tracking weight was identified in their evaluation framework.

The concept of weight tracking is common to the three different studies. Hence, it is considered as being an important element in evaluating weight loss and diet apps. As a result, weight tracking was included in the evaluation framework for this current study. To support the finding of content analysis, the literature was also reviewed to check the importance of weight tracking in the context of weight loss. According to Shigaki et al. (2014) in their research on weight loss,

*“Self-monitoring is key to successful weight loss, and information technology can make these tasks more convenient”. “When people use information technology to support their weight-loss efforts, they tend to access features that streamline the tracking of daily health behaviors”* (University of Missouri-Columbia 2014).

### **2. Ability of app to social support:**

This element covers the features of online social support and not the traditional social support. App should give users support so that they benefit from the experience of others in the social network who use the same app and share the same interests. In addition, the app should provide users with discussion board, or forum. Thus, the app was scored on whether it allowed users access to social support services such as message boards, chat rooms, email an expert, or a networking component like Twitter. This element was included, as it was common within the following four studies. Breton et al. (2011) have included the element of social support in their weight loss and diet evaluation framework.

*“App allowed users access to social support components like message boards, chat rooms, email an expert, or a networking component like Twitter”* (Breton et al. 2011, p.224).

The aforementioned quote clearly indicates the concept of online social support.

Likewise, the Azar et al. nutrition and diet evaluation framework included this feature.

*“Social support”* (Azar et al. 2013, p.585)

This element was found in their study without further explanation. The online social support was considered part of the term “social support” as the concept of social support is broader than the concept of online social support.

Also, the evaluation framework for IMS (2013) included the social support element.

*“Uses email provides secure communication, provides link to social networks”* (IMS 2013, p.54).

The quote clearly refers to online social support. In addition, the Pagoto et al. (2013) study identified seven technology-enhanced features that claimed to be directly relevant to the behavioral weight loss strategies, which included the element of online social support.

*“Online social network”* (Pagoto et al. 2013, p. 577).

The concept of social support was found in three different studies. Therefore, it was regarded as a significant element in evaluating weight loss and diet apps. As a result, it was included in the suggested evaluation framework for this research. To support the finding of content analysis, the literature was also reviewed to assess the importance of this element in the context of weight loss. According to Shigaki et al. (2014), social support is an important factor for the success of individual dieting. Smartphone apps can provide access to people and hence to social support, which is a significant attribute in weight loss studies (University of Missouri-Columbia 2014).

### **3. Availability of knowledge resource:**

This element evaluates whether an app increases user’s nutrition knowledge. The app was scored according to whether it provided a knowledge resource that can assist users of apps to increase knowledge/ information related to nutrition, and awareness of weight control or reduction. This element was included as it was found in the following three studies. Breton et al. (2011) included this element in their evaluation framework.

*“App recommended reading labels, described how to properly read labels, or let users look up nutritional information for food items”* (Breton et al. 2011, p.224).

The term “*look up nutritional information*” implicitly means allowing and encouraging users to read nutrition information.

The Azar et al. (2013) evaluation framework includes the concept of increasing knowledge explicitly.

“*Knowledge includes general information*” (Azar et al. 2013, p.585).

“*Includes level of detail of information, provides information as text, provides information as picture, provides information as video, provides audio information*” (IMS 2013, p.54).

As knowledge comprises information, the concept of knowledge was tacitly mentioned in the IMS evaluation framework.

The concept of increasing knowledge was found in three different studies. Thus, it was considered an important element in evaluating weight loss and diet apps. As a result, it was included to the suggested evaluation framework for the present study. To support the finding of content analysis, the literature was also reviewed to evaluate the importance of this element in the context of weight loss. Shigaki et al. (2014) in their research on weight loss points out that informational support is an important element for the success of individual dieting.

#### **4. Weight loss goal:**

This element covers the concept of weight loss goal. The app was scored on whether it recommends certain weight loss goals for their users, or whether it allows users to enter targeted weight. This element was taken into account as it was found in the following three studies. In Breton et al. study, it was stated as “*app recommended weight loss goals*” (Breton et al. 2011, p.224).

This was a clear indication of weight loss goal feature. Whereas in Azar et al.’s study, the weight loss goal element was named as

“*Realistic goal-setting*” (Azar et al. 2013, p.585), which could indicate the personal entering of goal.

In Pagoto et al. (2014) behavioral weight loss strategies, the concept of weight loss goal was impeded within one of the behavioral strategies (see table 5.1).

*“Weight-loss goal”* was the name of the strategy that indicated this feature (Pagoto et al. 2013, p. 577).

The concept of weight loss goal was taken into account in three different studies. Thus, it was considered as one of the main attributes in evaluating weight loss and diet apps. As a result, it was included in the suggested evaluation framework for this research. To support the finding of content analysis, the literature was reviewed to check the importance of this element in the context of weight loss. According to Ahtinen et al. (2009), displaying the progress towards goals can aid motivation to achieve such goals. Webber et al. (2010) states that weight loss intervention such as personal goal setting allows greater weight loss than a standard weight loss intervention. Goal setting is an autonomy supportive tool that could enhance autonomous motivation (Webber et al. 2010). Therefore, including the attribute of weight loss goal was important, as it is one of the motivational factors for using the apps for long term.

### **5. Regular physical activity:**

The app was also scored on whether it recommends a certain amount of physical activity. Although this element was only mentioned in two studies (Breton et al. (2011); Pagoto et al. (2013)), it was still included in the framework as there are many other references agreed on the importance of regular physical activity for weight loss. Breton et al. (2011) evaluation framework noticeably included this element

*“perform regular physical activity, scored on whether the app recommended a certain amount of physical each day per week”* (Breton et al. 2011, p.524).

Also, the behavioral weight loss strategies have clearly included this element.

*“Participants are encouraged to get 150 minutes of moderate- 20 intensity physical activity per week”* (Pagoto et al. 2013, p.578).

Although the concept of regular physical activity was only found in two of the studies (see table 5.2), it was still included in the evaluation framework for this study as of the obvious importance of physical activity in the context of weight loss. There is much available literature that supports the role of physical activities in weight loss. The following are just some examples: a higher level of physical activity is better for long-term weight loss (The American Journal of Clinical Nutrition 2003). Regular physical

activity and exercise reduce the risk of obesity (Thompson et al. 2003). Devotion to exercise may ultimately prove to be the cornerstone for long-term weight loss maintenance (Pronk and Wing 2012).

### *Overlooked Elements*

There were several elements that have been overlooked (e.g. time management, and stress reduction). These elements were only included in one or two of the studies. All the elements comprising in the evaluation framework for this study were included in all of the studies or in at least three of them. The only exception was the element of the physical activity because of its importance as previously mentioned. Conversely, the element related to the reminder function was mentioned in three studies namely (Azar et al. 2013; Pagoto et al. 2013; and IMS 2013). Nonetheless, it was not included in the evaluation framework for this study, as this function usually requires a period of time to examine all apps. Thus, the time constrain of this study prevented the inclusion of this element.

Table 5.2 summarises the wellness evaluation elements for each of Breton et al. (2011), Azar et al. (2013), IMS (2013), and Behavioral Weight Loss Strategies. Also, it shows the common elements between each of these studies. As previously mentioned in this chapter, the usability elements of the suggested evaluation framework were identified based on the common evaluation elements of these studies. The methodology chapter (3.6.2 and 3.7.1) has demonstrated how elements of evaluation framework and behavioural weight loss strategies were identified.

**Table 5.2 The Common Evaluation Elements Between The Four Studies.**

Elements of evaluation framework and behavioural weight loss strategies	Breton et al. (2011)	Azar et al. (2013)	IMS Institute for healthcare informatics (2013)	Behavioral Weight Loss Strategies Pagoto et al. 2013	Common Components
Calculate user BMI	X				
Eating a Diet Rich in Fruits/Vegetables	X				
Regular physical activity	X			X	
Drink Water Instead of soda and juice	X				
Keeping a food diary	X				
Calorie balance (in vs. out)	X			X	
Self monitoring user weight	X	X	X		X
Weight/Diet loss goal	X	X		X	X
Keeping a Physical Activity Journal	X				
Portion control	X			X	

## Chapter Five – Data Analysis of Evaluation of Framework - Phase Two

Elements of evaluation framework and behavioural weight loss strategies	Breton et al. (2011)	Azar et al. (2013)	IMS (2013)	Pagoto et al. 2013	Common Components
<b>Nutrition Facts/information/knowledge</b>	X	X	X	X	X
<b>Meal planning</b>	X			X	
<b>Social Support-</b> uses email, twitter or anything similar, provides secure communication, provides link to social networks	X	X	X	X	X
<b>Cognitive strategy - perceived benefits</b>		X			
<b>Cognitive strategy - perceived barriers</b>		X			
<b>Cognitive strategy - perceived risks</b>		X			
<b>Cognitive strategy - self-efficacy</b>		X			
<b>Cognitive strategy - self-talk</b>		X			
<b>Cognitive strategy - perceived social norms</b>		X			
<b>Behavior strategies- Time management</b>		X		X	
<b>Behavior strategies -Stimulus control,</b>		X		X	
<b>Behavior strategies -Self-reward,</b>		X			
<b>Behavior strategies-Modeling/vicarious learning,</b>		X			
<b>Behavior strategies- Relapse prevention</b>		X		X	
<b>Emotion- focused strategies Stress management</b>		X		X	
<b>Emotion- focused strategies -Negative affect management</b>		X		X	
<b>Therapeutic interventions - Skill-building/overview</b>		X			
<b>Therapeutic interventions - Motivational readiness</b>		X			
<b>Motivators</b> (social praise, financial incentives, nonfinancial incentives)		X			
<b>Features that decreased barriers, like tailored information</b>		X			
<b>Triggers to promote continued use of the app</b> (positive feedback for short- term task completion)		X			
<b>Automatic reminders/cues to use the app</b>		X	X	X	X
<b>Provide Instruction to user</b>			X		
<b>Graphically displays user entered data, and outputs user data, and provides guidance based on entry</b>			X		
<b>Can link to sensor</b>			X		
<b>Phone functionality</b> (use of phone's GPS, use of phone's camera, use of phone's scanner, use of phone's voice recorder)			X		
<b>Exercise safety</b>				X	
<b>Participants learn of the health benefits of making lifestyle changes.</b>				X	
<b>Food substitutions</b>				X	
<b>Review current food pyramid and its recommendations</b>				X	
<b>Participants are encouraged to engage in lifestyle activities</b> (e.g., parking further away)				X	
<b>Target heart rate</b>				X	
<b>Problem solving</b>				X	
<b>Social cues</b>				X	
<b>Develop regular pattern of eating</b>				X	
<b>Technology enhanced features-Barcode scanner</b>				X	
<b>Technology enhanced features-</b> a physical activity tracking device (e.g., accelerometer)				X	
<b>Technology enhanced features-</b> flags for lapses in dietary goal adherence				X	

### 5.3.2 Design Elements

As the design of a wellness application is important and none of the aforementioned previous evaluation studies focused on apps design in the evaluating of the wellness apps, the existence of good design strategies in apps was also assessed for this research. The studies related to wellness apps design strategies in the literature were rare and thus this field needs more investigations. The emphasis in Alagöz et al. (2010) study was to identify the design elements for wellness apps. Alagöz et al. (2010) point out the importance of considering the hedonic design aspects besides the functional side when developing health wellness app. According to them,

*“As the main goal of wellness applications, promoting a healthy lifestyle, depends on continuous and long-term usage, wellness applications should be developed in a way that users want to use it and should include emotional or affective designs. Thus good interface design should not only focus on mere functional aspects, but should also include hedonic aspects aiming at the user’s well-being, pleasure and fun”* (Alagöz et al. 2010, p. 43).

From this essence, Alagöz et al. (2010) suggested a set of design strategies of wellness applications and gave examples to apply these design strategies in apps (see Alagöz et al. 2010 page.44). Alagöz et al. (2010) claims that these design strategies aim to support behavioural change and social psychological theories. Also, these design strategies take into account hedonic aspects of wellness applications. The following list describes these strategies.

#### **1. Abstract & Reflective:**

“Abstract & Reflective” is concerned with the visual reflection of user’s entered data. Alagöz et al. (2010) state that the user entered raw data should be displayed in an abstract way in wellness applications to easily reflect user’s behaviours. For example, instead of demonstrating plain numbers, users collected data can be demonstrated on a virtual avatar or any visual effects such as graphs (Alagöz et al. 2010).

#### **2. Unobtrusive:**

This strategy named “Unobtrusive” states that the recent web applications should provide many graphical user interfaces that can be accessed from different mobile devices without requiring download (Alagöz et al. 2010).

### **3. Public:**

“Public” strategy actually refers to the opposite i.e. “Not Public”. To illustrate, this strategy means wellness apps should avoid unwanted disclosure of personal data from others. Wellness applications should not be seen as an icon and therefore prevent curiosity (Alagöz et al. 2010). Personal login is a common way of preventing others from accessing data that a user does not want to share (Alagöz et al. 2010). Thus, this strategy tacitly means “not public”.

### **4. Aesthetic:**

“Aesthetic” implies that a wellness app should take into account personal aesthetic preferences (Alagöz et al. 2010). Apps should offer some customizability and adaptability according to the personal aesthetic preferences (Alagöz et al. 2010).

### **5. Positive:**

“Positive” wellness design strategy indicates that wellness app should support users with positive reinforcement and avoid negative reinforcement (Alagöz et al. 2010).

### **6. Controllable:**

The “Controllable” strategy emphasises that users should be able to manage, edit data and control access to it (Alagöz et al. 2010).

### **7. Trending / Historical:**

“Trending/ Historical” strategy indicate that wellness apps should enable users to access historical data and allow showing their changes, progress and trends over a period of time (Alagöz et al. 2010).

### **8. Comprehensive:**

The last strategy of Alagöz et al. (2010) in wellness apps design strategies is “Comprehensive”. This strategy states that wellness apps should provide users with multiple data collection methods (Alagöz et al. 2010). Alagöz et al. (2010), points out that a wellness application should not only depend on sensory data, but also it should enable users to manually enter and edit data. Thus, combining sensory and manual data collection methods in one app consider a form of comprehensiveness.



### Interpretation and Discussion of the Design Elements

As the aforementioned strategies were recommended to apply in wellness apps development to encourage long-term usage, wellness apps that take into consideration these strategies are enhanced as compared to the other apps. This research has included six of these strategies in the evaluation framework “Abstract & Reflective”, “Public”, “Aesthetic”, “Controllable”, “Trending/Historical” and “Comprehensive”. The available resources of this research can only assist those six strategies out of the possible eight. Two of the strategies were excluded “Unobtrusive” and “Positive”. Evaluating the “Positive” strategy could not be undertaken as evaluating this strategy would involve difficulty in examining it. Studying if the app support users with positive reinforcement and avoid negative reinforcement requires extensive evaluation time of the apps. As this feature would exceed the time resource of this research, this strategy was excluded. The “Unobtrusive” strategy was also excluded as it required more resources than available to this research. The considered strategies were as follow):

#### 1. Abstract and reflective:

This strategy scores the apps on the basis of whether it uses a graph, chart or other virtual means to easily reflect the users data. It allows the user to clearly see their progress in an abstract and reflective way.

*“When people use information technology to support their weight-loss efforts, they tend to access features that provide visual feedback on their overall progress, like graphs showing weight lost over time”* (University of Missouri-Columbia 2014).

According to Ahtinen et al. (2008), the wellness application should be able to visualise and inform the users of progress. In the study of Ahtinen et al. (2009) to examine user experience in three wellness apps, the authors discovered that the main motivating factor, in one of the examined apps, specifically the Wellness Diary, was the graphs that provided long-term information about users progress.

#### 2. Public:

This strategy aims to evaluate an app on whether or not it provided a login feature or similar to avoid unwanted disclosure of user personal data. Ahtinen et al. (2009)

states that there are four factors related to the usability of health apps, which assist in the acceptance, and distribution of such technology in wellness promotion. These four factors are user-friendliness, usability, user competence, and confidence. Confidence is related to the system's performance and data security (Ahtinen et al. 2009). Thus, as the confidence is related to protecting users' data, it is considered to be a valuable attribute in promoting wellness technology and usability. The "public" feature covers the concept of confidence and therefore it is a useful feature.

### **3. Aesthetic:**

The apps were also scored on whether it enable user to customise or adapt some features in the app according to their personnel preferences. Ahtinen et al. (2009) claims that the user friendliness factor, which includes aesthetic presence and user interfaces is one of the main factors that promote using and accepting of wellness apps. Therefore, considering the aesthetic element in the evaluation framework is significant.

### **4. Controllable:**

Controllable is a strategy concerned with scoring an app on whether it allows a user to manage data and control access to it. Ahtinen et al. (2008) points out that manual entering of data appears to increase the user control over what parameters to enter. Also, it raises the awareness of the physical activity level, and thus increases the awareness of the physical activity level. Manual data entry can removes the issues of error-prone that could happen when the apps only depends on sensory data. The manual data entry allows users a level of control, and hence it was recommended to be included in the evaluation framework.

### **5. Trending / Historical:**

Trending and historical strategy scored an app on whether or not it enables a user to access historical data to show changes and trends. Ahtinen et al. (2009) states in their study of comparing between the three different wellness applications that, Wellness Diary application was considered the most motivating mobile app in the trial as it provided information on the long-term progress of different aspects of wellness, e.g. steps and weight. Thus, history data in wellness application is considered a motivating factor that allows long-term use; it should be included in the framework.

### 6. Comprehensive:

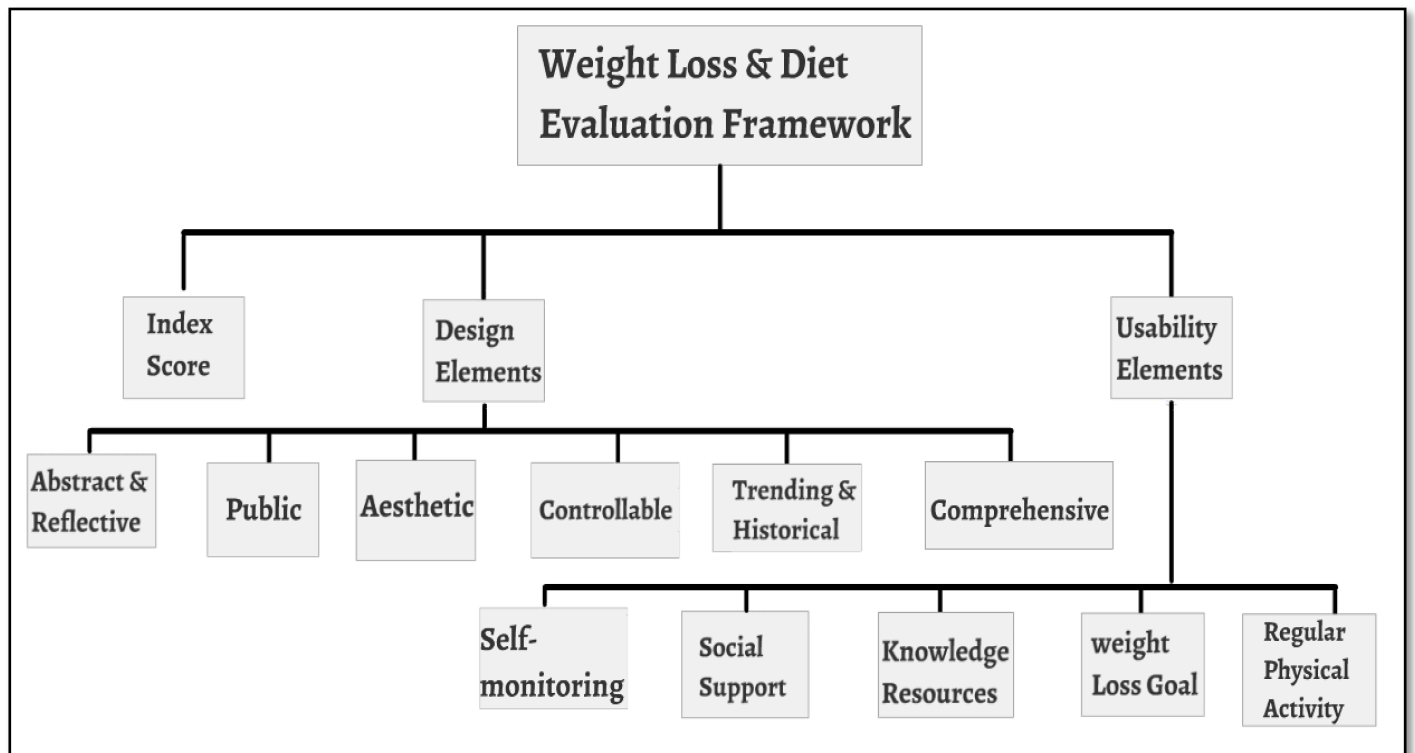
This strategy scored an app on whether it allowed users to manage data manually and whether it provides the option of collecting user sensory data. The perceived value of the wellness app has been relatively low in the short-term use when it depends only on manual data entries as it requires some effort (Ahtinen et al. 2009). Ahtinen et al. (2008) point out that automatic logging in removes the perceived burden of logging from users and allows continuous logging, as users do not forget to enter data. However, sensory entering of data could increase data errors, which the user may be not aware of. Therefore, combining automatic and manual logging is required (Ahtinen et al. 2008). Hence, this concept is covered under the element of comprehensive as it considers apps that allow users to manually enter data as well as collects sensory data more accurate than apps that just provide one of these features.

#### 5.3.3 Index Score

The last element of the evaluation framework is an element called the index score, which reflects the total scores for each of the usability and design elements. The index score was included in the evaluation framework as the apps evaluation method of this research was following the evaluation method of Breton et al. (2011). The ***Index Score*** is a scored determined based on the aforementioned 11 functionality and design elements of the developed evaluation framework. The sum of the scores provided a total value to the index score. Index score values ranges from 0 to 11 with 11 being the maximum possible score. Therefore, to rank the apps according to the evaluation framework, it required collecting the total number of 11 elements that has been gained by an app in the index score.

Figure 5.1 summarises the suggested elements of the developed evaluation framework.

Figure 5.1The Developed Weight Loss and Diet Evaluation Framework



### 5.4 CHAPTER REFLECTION

This chapter has presented the results of the content analysis of the literature and has identified the method and elements of the proposed evaluation framework that was used to evaluate the weight loss and diet apps. The identified apps evaluation method has followed Breton et al. (2011) approach. The design, usability and index score elements form the main three initial finding of phase two. Therefore, the developed weight loss and diet evaluation framework is the first main outcome of this research. The identified elements of the evaluation framework are as follow:

- 1) Ability of app to self-monitoring
- 2) Ability of app to social support
- 3) Availability of knowledge resource
- 4) Weight loss goal
- 5) Regular physical activity
- 6) Abstract and reflective
- 7) Public
- 8) Aesthetic
- 9) Controllable
- 10) Trending/ Historical
- 11) Comprehensive
- 12) Index Score.

The next chapter will present the practical application of the evaluation framework.

Chapter Six  
Practical Application  
of Evaluation  
Framework  
Phase Three

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## **6. PRACTICAL APPLICATION OF EVALUATION FRAMEWORK- Phase Three and Discussion of Initial Findings**

### **6.1 INTRODUCTION**

This chapter demonstrates the application of the developed evaluation framework (see chapter 5) on the identified iTunes and Google Play apps (see chapter 4). This research has included all the identified apps and has applied the evaluation framework to. This chapter includes the following sections:

- Section 6.2 presents an overview of the evaluation process of the selected apps. Applying the evaluation framework require downloading the identified iOS and Android apps (see chapter four). Then, each of the apps was examined to determine whether the elements of the evaluation framework were present on not (see 5.3.1 and 5.3.2). The method of evaluating the apps and the elements of the evaluation framework were previously discussed in section 5.2 and 5.3. Section 6.2.1 demonstrates the outcomes of applying the evaluation framework to the identified iTunes apps. Firstly, the identified iTunes apps were downloaded (see section 4.2.3) then the developed evaluation framework was used to evaluate these apps. Section 6.2.2 presents the outcomes of applying the evaluation framework on the identified Google Play apps. The identified Google Play apps were downloaded (see section 4.3.3) and examined using the developed evaluation framework.
- Section 6.3 shows the frequency of occurrence of the evaluation framework elements that found in the iTunes and Google Play apps when evaluated them using the developed evaluation framework.
- Section 6.4 shows a comparison of applying the developed evaluation framework on iTunes and Google Play apps.
- Section 6.5 discusses and interprets the main initial findings resulting from application of the evaluation framework on the iTunes and Google Play apps.

## 6.2 APPLICATION OF THE EVALUATION FRAMEWORK

Applying the developed evaluation framework (see section 5.2 and 5.3) on the identified iTunes and Google Play apps (see chapter 4) required installing the 51 apps on iOS and Android devices (see section 4.2.3 and 4.3.3). The iTunes apps were downloaded into an iPhone 4 smartphone and the Google Play apps were downloaded onto LG nexus 4 smartphone. Appendix 8 demonstrates the worksheet that was used in evaluating iTunes apps. Appendix 9 presents the memos of each of the iTunes apps that were noted during the evaluation process. Similarly, while appendix 10 shows the worksheet that was used in evaluating Google Play apps, appendix 11 presents the memos of each of the Google Play apps that were noted during the evaluation process. The memos sheets in appendix 9 and 11 show the dates of when each app was downloaded and the duration of each app evaluation.

### 6.2.1 Applying the Evaluation Framework on the iTunes Apps

The downloaded iTunes apps were grouped into categories according to their index scores values. The following table shows the evaluation results of iTunes apps:

Table 6.1 Shows the results of the evaluation of iOS apps

App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Abstract and reflective	Public	Aesthetic	Controllable	Trending/Historical	Comprehensive	Index Score
Weight Loss Hypnosis by Mindifi- Lose Fat with Better Health and Meditation (©Mindifi)												0
Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... (©Surf City Apps LLC)		X										1
Low Fat Recipes- Diet, Lose Fat, Lose Weight (© AC)			X									
I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet (© 2013 I feel Good Pty Ltd)			X									
CalorieKing Australia Food Search (© CalorieKing Wellness Solutions, Inc.)			X									
Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)					X							



## Chapter Six – Practical Application of Evaluation Framework – Phase Three

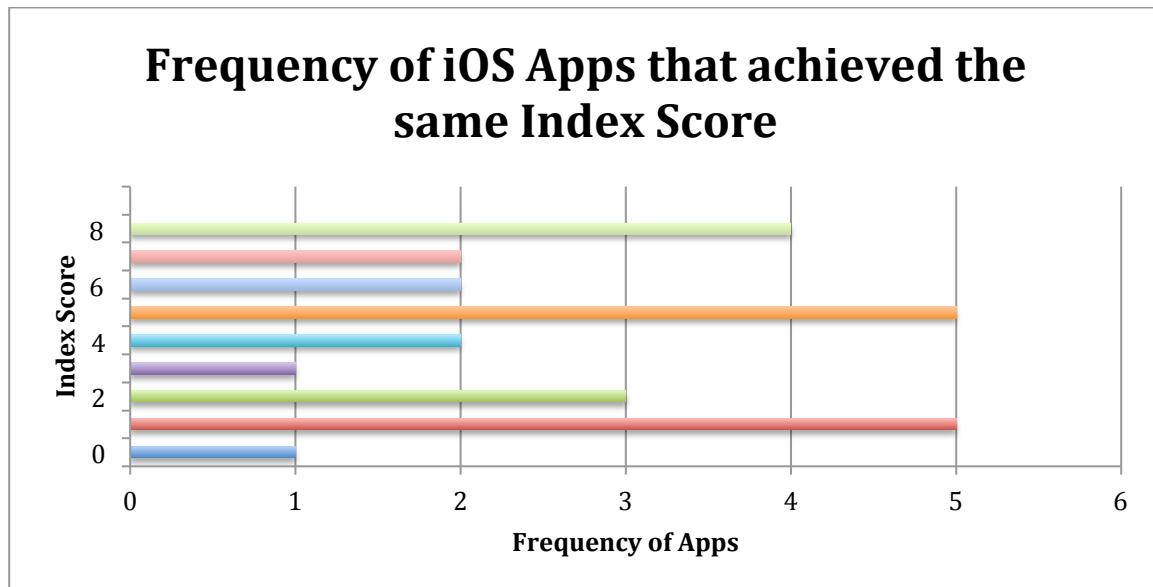
App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Abstract and reflective	Public	Aesthetic	Controllable	Trending/Historical	Comprehensive	Index Score
Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss (©2012-2013 Clear Sky Apps Ltd)		X			X							2
Belly Fat Workout Free-10 Minute Ab Exercises (©procodemedia.com 2012)		X			X							
Nutrition Quize: 600+Facts, Myths & Diet Tips for Healthy Living (©2013 runtastic GmbH)		X	X									
Best Diet Foods- how to keep fit with diet (© zky)		X	X					X				3
Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution (©2013 everyday Health Inc.)			X	X	X				X			4
Walkmeter GPS Pedometer- Wlaking Running Hiking for weight Loss Wlak Tracker (©2014 Abvio Inc.)					X			X	X		X	
My Diet Coach- Weight Loss for Women (© 2012 InspiredApps)	X		X	X				X	X			5
Nexercise- motivation to lose weight, to finally meet your weight loss & health goals (© 2014 Nexercise Inc.)	X	X			X	X				X		
Happy Scale:Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log...(© Front Pocket Software LLC)	X			X		X	X		X			
My Diet Diary- Your Personal Calorie Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking (© 2012-2014 MedHelp)		X	X	X	X				X			
Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter (© 2014 MapMyFitness Inc)		X	X		X				X		X	
Nutricise-Meal Planner & Weight Loss Programs (©2013 Nutricise Pty Ltd)	X		X	X	X	X			X			6
Australian Calorie Counter- Easy Diet Diary (© 2013 Xyris Holdings Pty Ltd)	X			X	X	X			X	X		
MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health (© IIVESTRONG.COM)	X	X		X	X	X			X	X		7
Calorie Counter and Diet Tracker by Calorie Count (© 2012 About, Inc.)	X	X	X	X	X	X			X			
Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss (© 2013, MapMyFitness, Inc.)	X	X		X	X	X			X	X	X	8
Calorie Counter & Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)	X	X		X	X	X	X		X	X		
TactioHealth (Weight Loss, Fitness, Hypertension & Diabetes Family eHealth Tracking System) (©2011-2014 Tactio Health Group Inc.)	X	X		X	X	X	X		X	X		
Fitbit (© 2014 Fitbit, Inc.)	X	X		X	X	X			X	X	X	

Figure 6.1 shows the frequency of iTunes apps that had the same index score. The index scores of five and one were each repeated five times. They were the most frequently found values of all the other index scores. Only one app recorded a zero value, which was the lowest value for the index score. Three apps scored an index score of two. While one app scored three, two apps had an index score of four. Four apps have scored 8, which were the highest value obtained.

### *Initial Finding One*

The results of analysing the iTunes apps have shown that none of the apps achieved the proposed highest value of the index score, which is 11.

**Figure 6.1 The Frequency Of iOS Apps That Had Taken The Same Index Score**



As the index scores are discrete numbers, three measures of central tendency were utilised to provide additional analysis of the data. According to Saunders, Lewis, and Thornhill (2009), all of the mode, median and mean can be employed to measure the central tendency of numerical discrete data. Table 6.2 summarises the mode, median, and mean of the index score values of the iTunes apps.

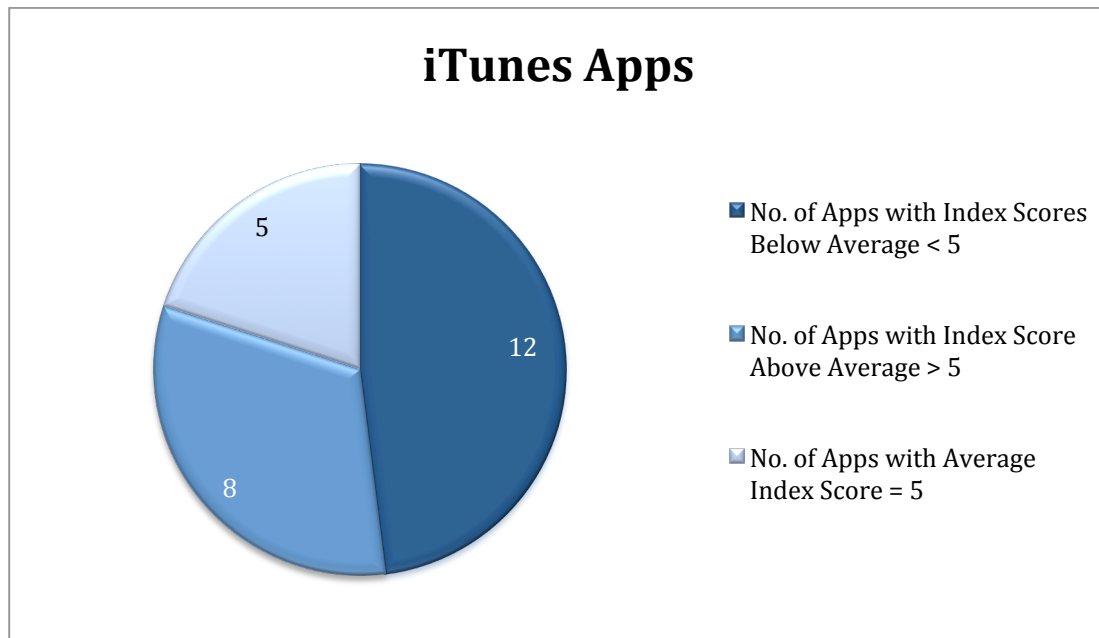
**Table 6.2 Measure of central tendency for the IOS index score values**

Measure of Central Tendency	Result
Mode	1, 5
Median	5
Mean	4

The mode represents the value that accorded most frequently in the data, which were 1, and 5. The median represents the middle value of the index score values, which was 5. The mean represent the average value of all index score values, which was 4. Since a mode of one was far from the median and mean results, five would be the more appropriate value of mode. Therefore, five could be considered as an average index score value.

Figure 6.2 shows that when applying the evaluation framework to the iTunes apps, twelve apps achieved an index score value below the average i.e. below 5; only eight apps scored an index value above the average and five apps scored values similar to the average. This indicates that the number of apps that achieved an index score values below the average was higher than the number of apps that scored values above the average.

**Figure 6.2 Number of iTunes apps that achieved index scores below, equal or above the average.**



### 6.2.2 Applying The Evaluation Framework On The Google Play Apps

The installed Google Play apps were grouped into categories according to their index score values. The table below shows the evaluation results of the identified Google Play apps:

Table 6.3 Shows the results of the evaluation of Google Play apps

App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Abstract and reflective	Public	Aesthetic	Controllable	Trending/Historical	Comprehensive	Index Score
Valentine's Weight Loss												0
BMI Calculator – Weight Loss									X			1
10 Best Weight Loss Diet Plans			X									
BMI Calculator -Weight Loss				X					X			2
Diets for losing weight	X					X						
Weight Loss & Healthy Foods		X	X									3
Effective Weight Loss Guide			X		X				X			
Point by Point – Diet Lite				X					X	X		4
My Diet Coach – Weight Loss		X	X	X				X				
Diet Point · Weight Loss	X	X		X					X			
Simple Weight Recorder				X		X			X	X		5
Diet Diary (Diet Calendar)	X					X			X	X		
Nexercise = fun weight loss	X	X				X			X	X		
Weight Loss Tracker – RecStyle	X	X		X		X		X				6
My Diet Diary Calorie Counter		X	X	X	X				X			
Diet Assistant – Weight Loss	X	X		X		X			X	X		
Monitor Your Weight	X			X		X	X		X	X		7
Weight control	X			X		X		X	X	X		
Weight War	X			X		X	X		X	X		
Weight Diary	X			X		X	X		X	X		8
Weight Track Assistant	X			X		X	X		X	X		
Diet Plan	X		X	X	X	X			X			
Photo diet	X			X		X	X		X	X		9
Noom Weight Loss Coach	X	X	X	X	X	X			X	X		
Calorie Counter – MyFitnessPal	X	X		X	X	X	X		X	X		
Calorie Counter & Diet Tracker	X	X	X	X	X	X	X	X	X			9

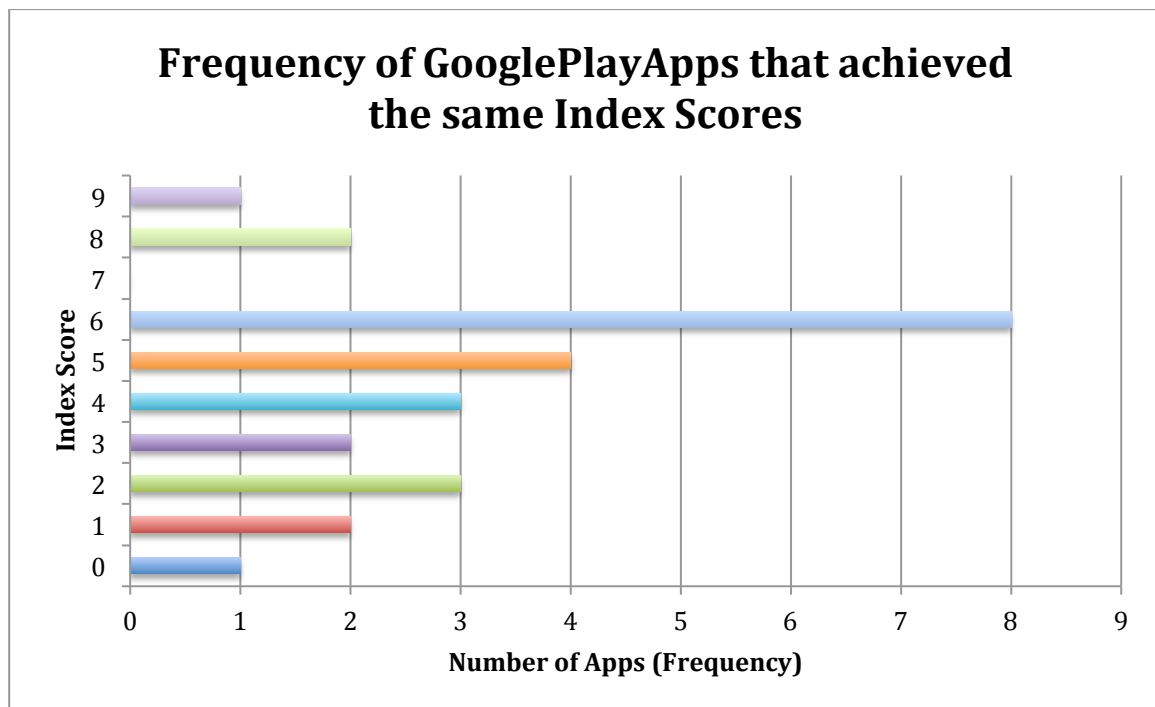
Figure 6.2 presents the frequency of Google Play apps that achieved the same index scores. The index score of six was achieved eight times, which was the most accorded value of all the other index scores values. While only one app was awarded zero, which was the lowest value for the index score, only one app achieved a score of a nine, which was the highest awarded index score value out of a possible eleven. Two apps achieved a one as their index score. Three apps scored two. Two of the apps were

awarded an index score of three. Four apps scored four as their index score values. Three apps were scored a five and two of the apps were awarded an index score of eight.

### *Initial Finding Two*

Analysing the Google Play apps showed that none of the apps achieved the proposed highest value of the index score i.e. 11.

**Figure 6.3 The frequency of Android apps that awarded the same index score**



As with the iOS apps, the same three measures of central tendency were used to provide additional analysis on the Google Play apps' index scores. Table 6.4 shows the mode, median, and mean of the index score values that were achieved by the Google Play apps.

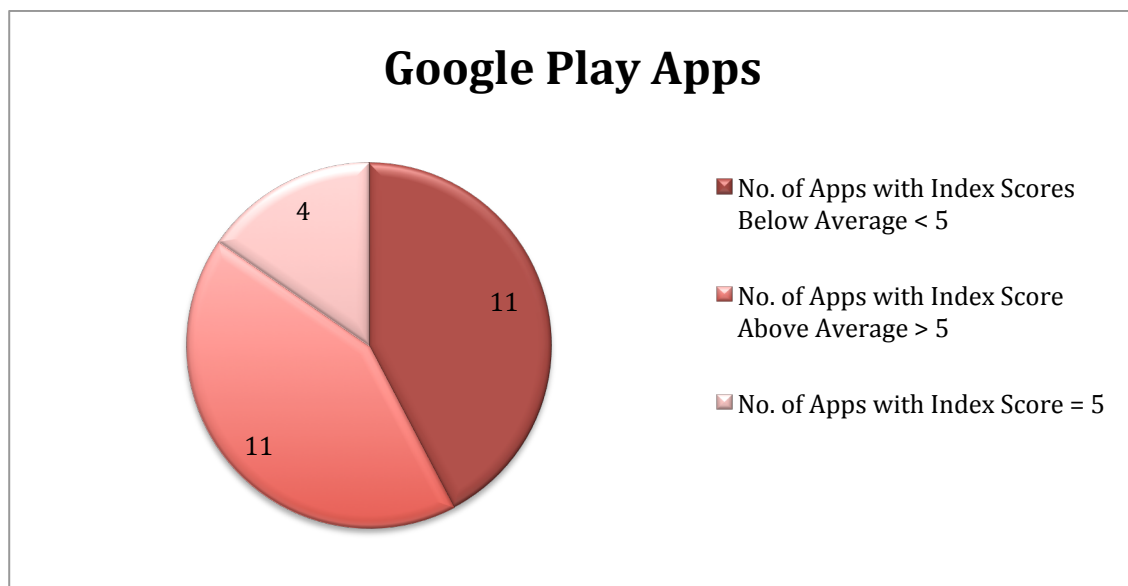
**Table 6.4 Measure of central tendency for the Android index score values**

Measure of Central Tendency	Result
Mode	6
Median	5
Mean	5

Six was the mode, representing the value that was obtained most frequently for the data. The median represents the value that is located exactly in the middle of the data after arranging it in order. The median for the index scores of the Google Play apps was five. The mean represents the average value for the set of index scores of the Google Play apps. The mean of the index scores of all Android apps was five. Since the mean and the median were five and the mode was six, which was a close value, five could be considered the average value of the index scores of the Google Play apps.

Figure 6.4 shows that applying the evaluation framework to the Google Play apps resulted in eleven of the apps scored values below the average index score (i.e. 5). Also, eleven apps were awarded values above the average index score and only four apps scored a value similar to the average index score. This indicates that the number of apps that achieved an index score values above the average was equal to the number of apps that scored below the average.

**Figure 6.4 Number of Google Play apps that achieved index scores below, equal or above the average.**



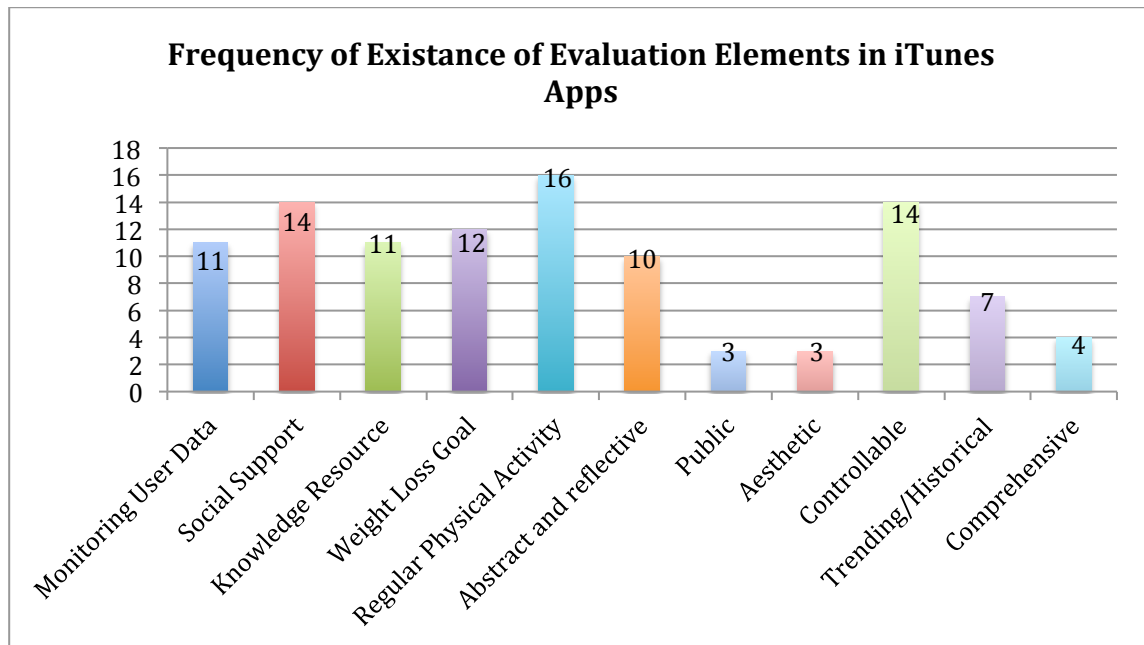
### 6.3 OCCURRENCE FREQUENCY OF EVALUATION FRAMEWORK ELEMENTS

Figure 6.5 and 6.6 show the frequency of existence of each element of the evaluation framework for both iTunes and Google Play apps respectively. These results can assist apps' developers and designers in improving wellness apps. Also, it allows paying attention to be paired to elements that did not exist in the app even though those elements may be significant.

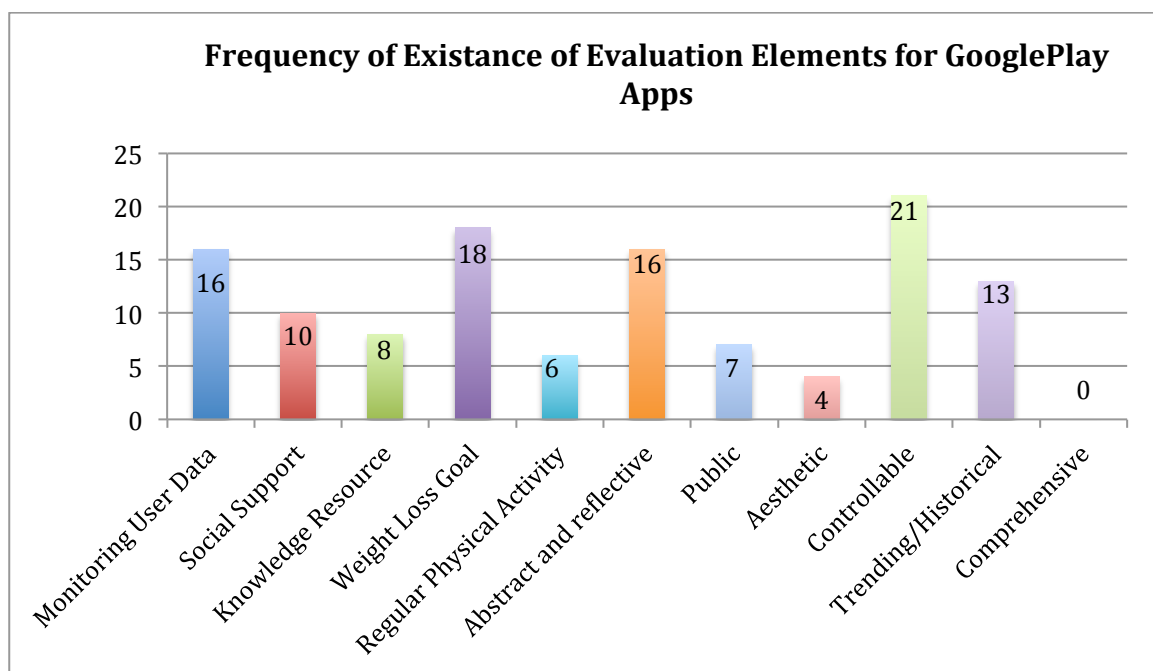
### *Initial Finding Three*

Although the evaluation framework elements developed were based on the available literature, the presence of each of these evaluation elements in the identified apps in both stores supported the evaluation framework.

**Figure 6.5 Frequency of existence of evaluation elements in iTunes Apps**



**Figure 6.6 Frequency of Existence of Evaluation Elements in Android Apps**



## **6.4 COMPARISON OF APPLYING THE EVALUATION FRAMEWORK BETWEEN ITUNES AND GOOGLE PLAY APPS**

In terms of the maximum and minimum achieved index scores, the maximum index score eight was achieved by four of the iTunes apps when applying the evaluation framework. Whereas the minimum score zero was only achieved by one app (see table 6.1). On the other hand, when applying the evaluation framework to the Google Play apps, the maximum index score achieved was nine, which was obtained by only one app, whereas the minimum score was zero that also occurred in only one app (see table 6.3).

When applying the evaluation framework on iTunes and Google Play apps, the mode was utilised to identify the most common index score. While the index scores of five and one had occurred each five times in the iTunes store, the index score of 6 was achieved eight times for the Google Play apps; this was the most accorded value (see table 6.1 and table 6.3).

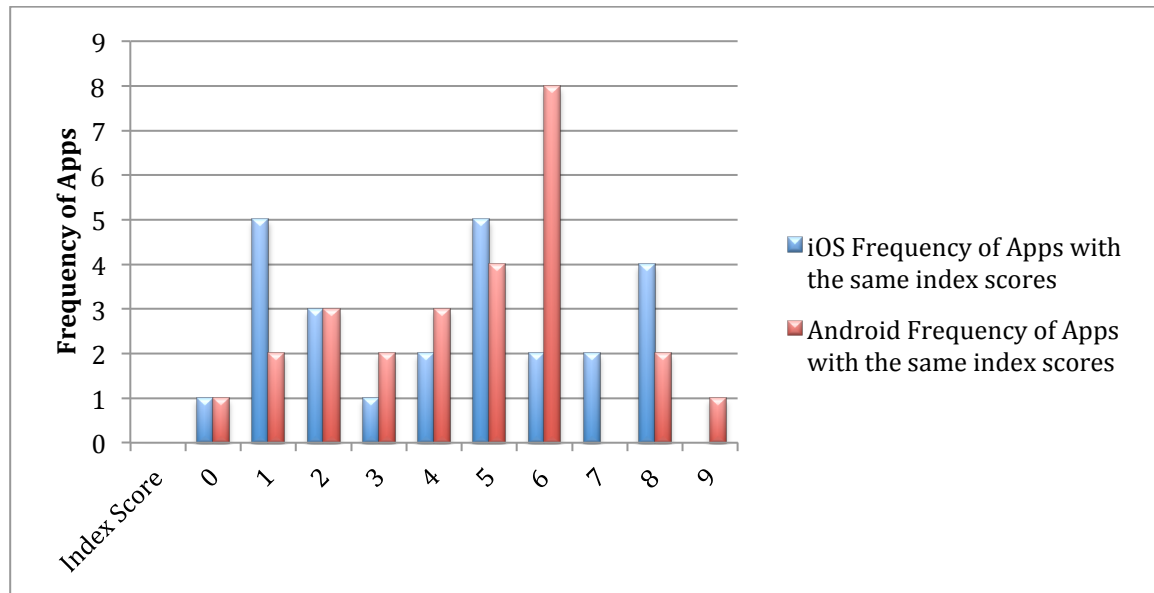
While five iTunes apps recorded an index score of one, only two apps in the Google Play store scored one out of a possible total score of eleven. Three apps recorded an index score of two in both stores. Only one app scored three out of eleven in the iTunes store and two apps scored three in the Google Play store. Two apps scored four when applying the evaluation framework onto the identified iTunes apps and four Google Play apps were awarded similar index score. One fifth of the iTunes apps scored five as their index score whereas three Google Play apps were awarded five. Although eight of the Google Play apps were awarded an index score of six, only two of the iTunes apps achieved similar score. While two of the iTunes apps were awarded an index score of seven, none of the Google Play apps obtained this index score. In the iTunes store, four apps achieved a score of eight out of eleven whereas two of the Google Play apps scored an eight. The index score of nine out of eleven was not obtained by any of the iTunes apps. However, it was achieved once in the Google Play store, which was the highest achievable score out of all identified apps. Finally, the index score of 10 and 11 have never been awarded to any of the identified iTunes and Google Play apps (see table 6.1 and table 6.3).



To summarise, the results of analysing the identified iTunes and Google Play apps showed that none of the identified apps achieved the proposed highest value for the index score.

Figure 6.7 summarises the previous comparison of applying the evaluation framework into the iTunes and Google Play apps.

**Figure 6.7 Comparison of The Index Score Values That Have Gained by the Android and iOS Apps**



The mode represents the value that accorded most frequently in the data, which was one and five for the iTunes apps, and six for the Google Play apps. The median represents the middle value, which was the index score that separates the upper scores from the lower scores. For both iTunes and Google Play apps, the median index score was five. Since a mode of one was low index score and relatively far from the median and the mean of the identified iOS apps, it was reasonable to consider five as the appropriate mode of the iOS data set. In addition, since two of the measures of central tendency of the iTunes and Google Play apps determined five as an index score, five could be considered the average index score for both stores. Table 6.5 demonstrates the measures of central tendency of iTunes and Google Play apps.

**Table 6.5 Measure Of Central Tendency For The iOS And Android Index Score Values**

Measure of Central Tendency	iTunes apps	Google Play apps
Mode	5	6
Median	5	5
Mean	4	5

### *Initial Finding Four*

Figure 6.8 compares the frequency of occurrence of each element of the evaluation framework between the iTunes and Google Play apps. In the iTunes apps, all of the usability elements were present at least once. However, in the Google Play apps, all of the usability elements were present at least in one app except the usability element of comprehensive. None of the Google Play apps have satisfied the usability element of comprehensive. ‘Comprehensive’ was the last element of the developed evaluation framework. It was previously identified and discussed in chapter 5 and 5.3.

**Figure 6.8 Comparison between The Frequency of Present Usability Evaluation Elements within iOS and Android Apps**

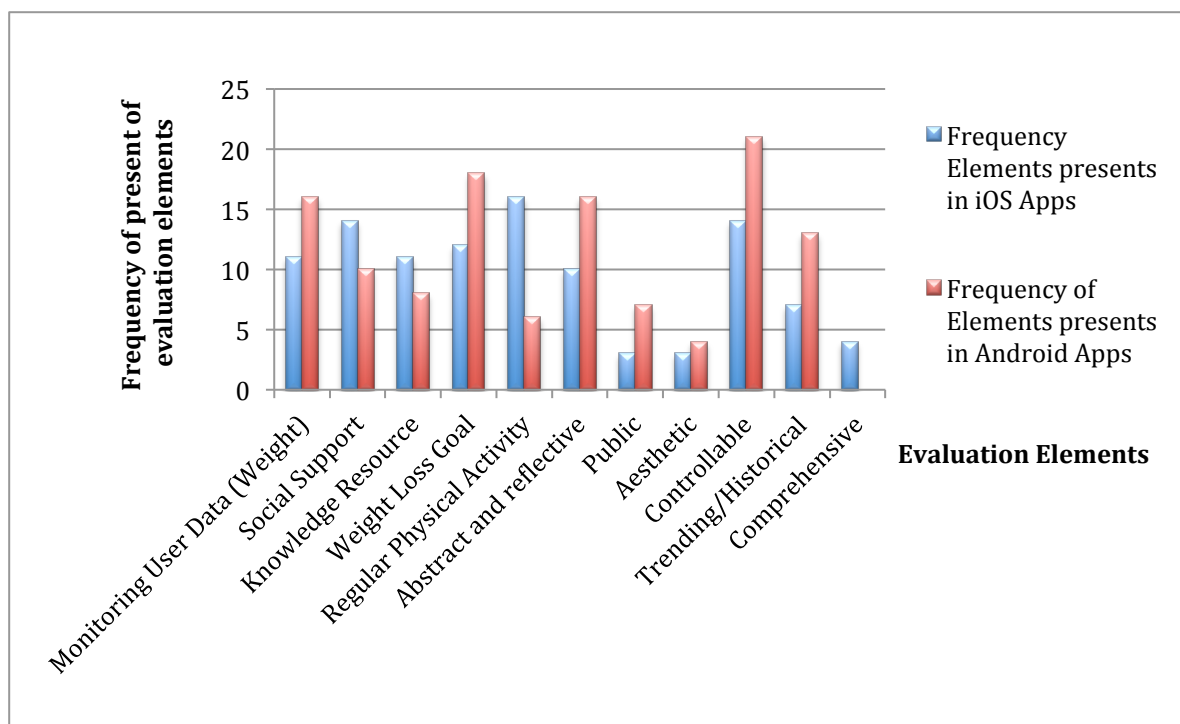


Figure 6.9 shows a comparison between the number of iTunes and Google Play apps that fell below the average category. 12 out of 25 iTunes apps obtained index scores below the average (5). Whereas, 11 out of 26 Google Play apps have scored below the average. This indicates that the proportion of iTunes apps that fell below the average category is slightly higher than the proportion of the Google Play apps. While 48% of the identified iTunes apps had obtained scores below average, around 42% of the identified Google Play apps were given index scores below the average.

**Figure 6.9 Comparison between Number of iOS and Android Apps with Index Scores below the Average**

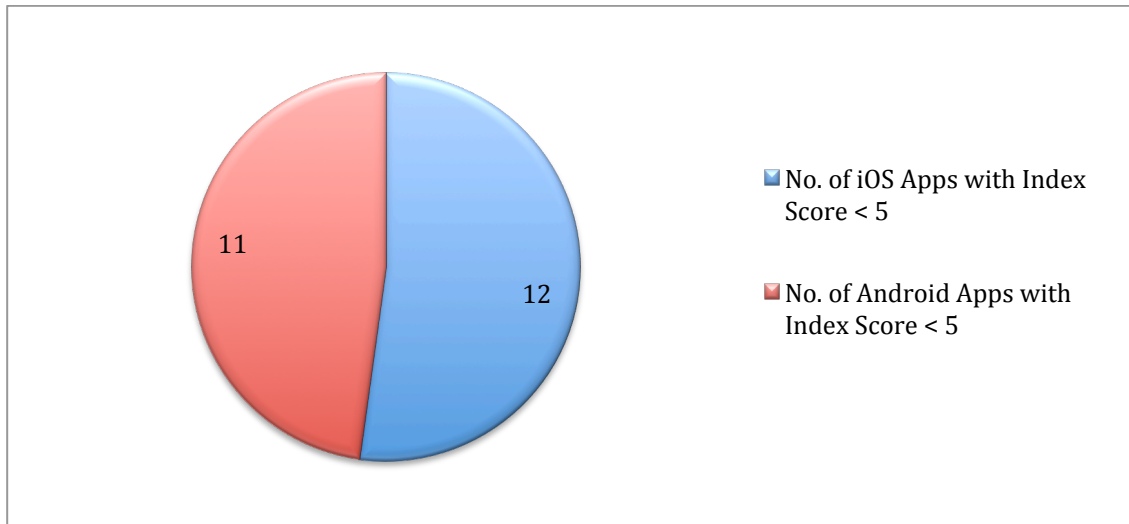
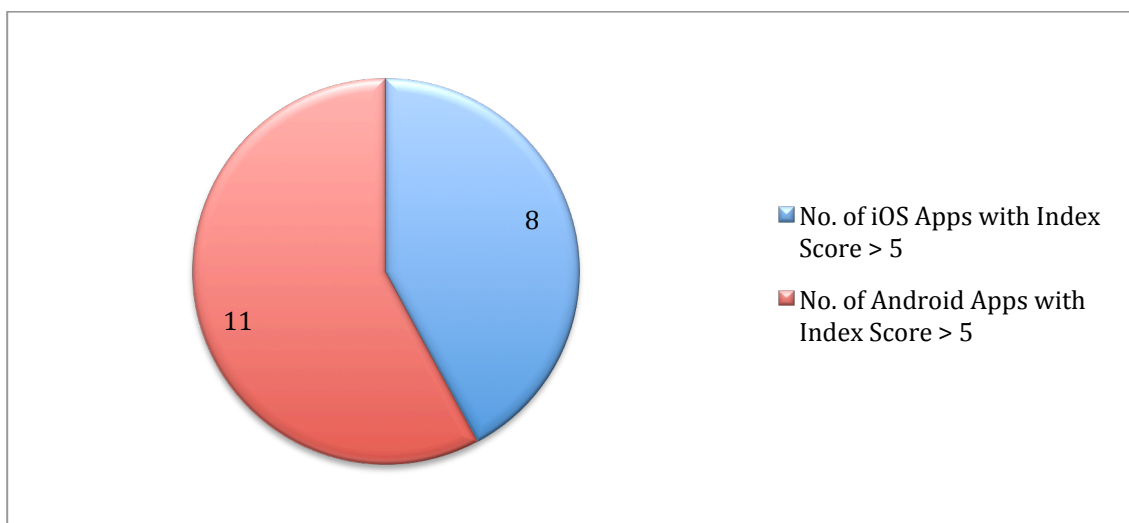


Figure 6.10 compares the number of iTunes apps with the number of Google Play apps that achieved index scores above the average (5). While only 8 out of 25 iTunes apps achieved index scores above the average, 11 out of 26 Google Play apps achieved index scores above the average. This indicates that more Google Play apps managed to achieve index scores above the average than the identified iTunes apps.

**Figure 6.10 Number of iOS Apps with index scores above average compared with Android Apps**



**Figure 6.11 Summary of Comparison between the numbers of iOS/Android Apps with Index Scores below/above the average**

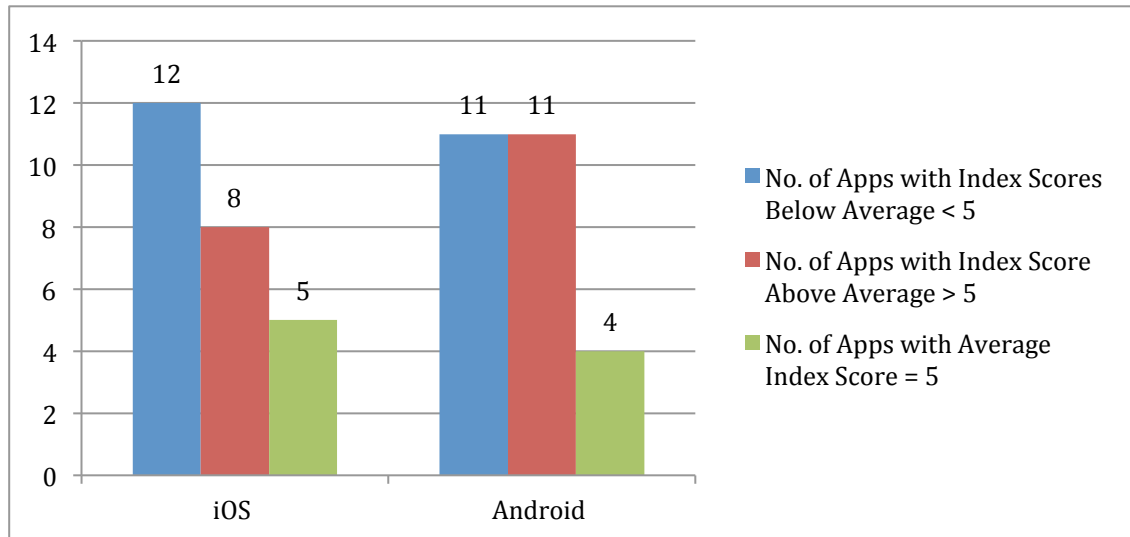


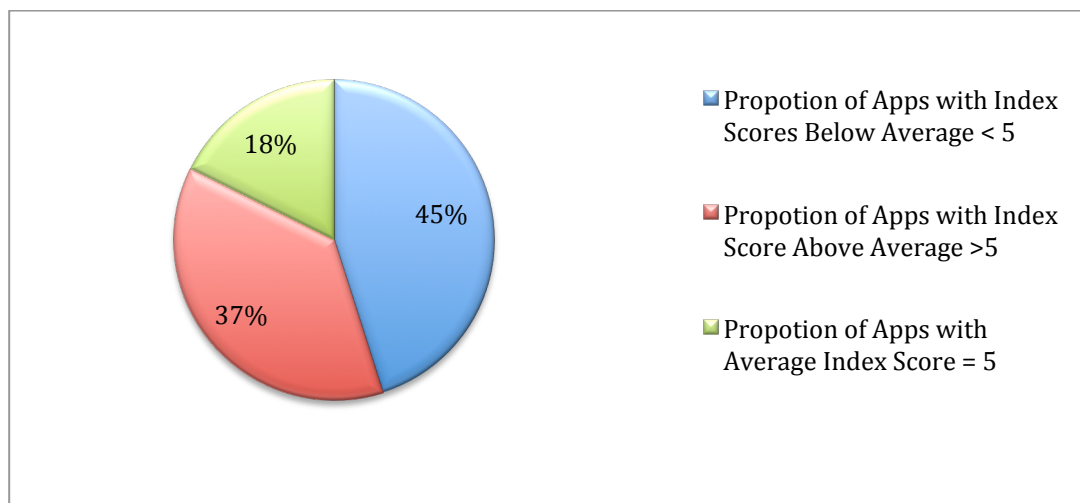
Figure 6.11 above summarises the aforementioned comparison of the index scores between the iTunes and Google Play apps.

The outcomes of applying the evaluation framework to the iTunes and Google Play apps resulted in 18% out of 51 apps fell under the average index score category. Whereas, 37% out of 51 apps were categorised as above average and 45% out of 51 were below average index scores (See Figure 6.12).

### *Initial Finding Five*

The aforementioned outcome indicates that the proportion of apps with index scores below the average was higher than the proportion of the apps with index scores above the average.

**Figure 6.12 Proportion of iTunes and Google Play Apps Index Scores compared to the Average Index Score.**



## **6.5 DISCUSSION AND INTERPRETATION OF THE INITIAL FINDINGS**

This section presents the interpretation and discussion of the significant initial findings that result from the application of the evaluation framework to the identified iTunes and Google Play apps.

- **Initial Finding One**

The outcomes of applying the developed evaluation framework on the iTunes apps were presented in section 6.2. The outcomes showed that none of the iTunes apps have achieved the proposed highest index score of 11. Even though the identified apps were the most top popular iTunes apps based on the developed evaluation framework, none of these apps were able to achieve the maximum index score of eleven. This was an interesting initial finding as it was expected that at least one of the most popular apps should achieve the highest index score. There are two claims to interpret this initial finding:

The first claim is that iTunes search engine may only consider the keywords entered by the users to retrieve the apps. If the search engine retrieves apps only according to the apps keywords without considering the real functionality or the quality of apps, some of the retrieved app may not be related to the required function that meet the user's needs. Although the apps identified in this study were eliminated from the apps that were unrelated to the weight loss and diet (see chapter 4, section 4.3), the elimination made was only based on the description pages of the apps, which may not truly reflect all apps details. Consequently, retrieving apps only by considering the keywords included in the apps may result in downloading some apps that are not truly related to the weight loss and diet. Hence, when these apps were evaluated using the developed evaluation framework, they achieved low index scores.

According to Goetz (2013), the iOS search engine retrieves apps based on the app name, company name and keywords only in the iTunes store. Most apps constrain their names to 12 characters, which are the viewable limit of characters to be displayed on the home screen (Goetz 2013). If the company name forms a part of the app name, it does not necessarily represent the functionality of the app (Goetz 2013). Also, the developers are restricted to limit the apps keywords to a total of hundred characters, which raise the issue of inability of find apps by users (Goetz 2013). Clarifying this

issue is beyond the scope of this research. Goetz (2013) also states that although developers are allowed to use four thousand characters to describe an app and its functionality, that information is not utilised in the search. Similarly, Datta, Kajanana, and Pervin (2013), state that there is a need for an effective system for discovering and searching applications. There is a need for an effective “search engine” for apps in the native app markets (iTunes and Google Play) (Datta, Kajanana, and Pervin 2013). According to Rogers (2014), given that 86% of the time users spend on using their apps, there is a need to have an easy access to the best apps for them. This should not be only access to the most popular. However, they want to be able to have apps based on a complex search that understand their needs and usage patterns (Rogers 2014).

*“I don’t want to search the charts; this is like music CDs in the 90s. You would watch the billboard and listen from that. I want to be able to get apps based on complex search and which understand much more of my needs and usage patterns,”* says The Football App CTO Jonathan Lavigne in the study of (Rogers 2014).

The second claim is that the most top popular iTunes app does not necessarily indicate the usability or efficacy of the app. When many users download these apps, these apps would be ranked higher in the iTunes store, as the number of times these apps are actually used is disregarded. As previously mentioned in section 4.2.2, one of the elements of the ranking algorithm of the iTunes store is the download popularity of the apps (Apple Inc. Customer Support, January 2012, Abroms et al. 2013; Rogers 2014). This means that when the retrieved app is downloaded many times by many users, it is going to be ranked higher in the iTunes store disregarding the quality of the app or the frequency of that particular app being used. Therefore, this may indicate that the top popular apps that are ranked higher in the iTunes store do not necessarily mean that the app is usable or substantially beneficial compared to other lower ranking apps. This initial finding indicates that the iTunes ranking method is not efficient and needs some improvement. In the study of Rogers (2014), one of the participants said when asked about what needed to be change in discovering iTunes apps:

*“Make [app search] more semantic”, “personalization!”, and “it would be good if apps that users use frequently were ranked higher than apps that users download and use just once or twice”.*

In fact, apps need to be ranked higher not only because they were download the most, but rather as of their functionality and usability. This also tacitly implies that apps which are ranked high in the iTunes store are not essentially the most usable and valuable apps.

- **Initial Finding Two**

Section 6.2 has presented the findings developed by applying the evaluation framework on the Google Play apps. The outcomes showed that none of the Google Play apps have achieved the highest proposed value of the index score, which were also eleven. The identified apps were of the most top popular Google Play apps. Nonetheless, none of these apps were able to achieve the full index score of eleven. This finding was similar to the initial Finding One. Thus, the two aforementioned claims that interpret the first initial finding were reintroduced here again.

This outcome may result if Google Play search engine merely considers keywords entered by users to retrieve the apps for them. If the search engine retrieves apps only according to the apps keywords without considering the real functionality or the quality of apps, some of the retrieved apps may not be well related to the function required to meet the user's needs. Therefore, retrieving apps only by considering the keywords of app may result in downloading some apps that are not truly related to the weight loss and diet apps. Hence, when evaluated using the developed evaluation framework, those apps achieved lower index scores.

Datta, Kajanan, and Pervin (2013), state that there is a need for an effective system for discovering and testing applications. There is a need for an effective “search engine” for apps in the native app markets (iTunes and Google Play) (Datta, Kajanan, and Pervin 2013).

On the other hand, the second claim is that the most popular Google Play apps do not give an appropriate indication of the apps usability or efficacy.

To summaries the above-mentioned findings, there was no one app from both stores that achieved the highest proposed index score value. On the basis of the developed evaluation framework, the achieved results for the top popular iTunes and Google Play apps indicates that the most downloaded ones are not necessarily the most usable and effective apps. It may be just that users irregularly use the most downloaded apps.

- **Initial Finding Three**

The existence of all elements of the evaluation framework in the iOS and Android apps ensure the correctness of the evaluation framework. To illustrate, all the identified eleven elements were present in at least one or more of the iOS and Android apps. This indicates that none of the identified elements were irrelevant or inappropriate in evaluating weight loss and diet apps.

The first element in the evaluation framework was the ‘**Ability of app to self-monitoring** (*monitoring user data (weight)*)’. This element was included in the evaluation framework as it was found in three wellness apps related studies (see section 5.3.1). To support the finding of the content analysis the literature was reviewed to additionally check the importance of this element in the context of weight loss and diet apps. According to Shigaki et al. (2014) in their research on weight loss,

*“Self-monitoring is key to successful weight loss, and information technology can make these tasks more convenient”. “When people use information technology to support their weight-loss efforts, they tend to access features that streamline the tracking of daily health behaviors”* (University of Missouri Columbia 2014).

Accordingly, this evaluation element should be in weight loss and diet evaluation frameworks.

The second evaluation framework element was the ‘**Ability of app to social support**’. This element was included in the developed framework, as it was a common element in four studies (see section 5.3.1). To support this finding of the content analysis the literature was also reviewed to assess the importance of this element in the context of weight loss and diet apps. According to Shigaki et al. (2014) in their research on weight loss, social support is an important element for the success of individual dieting. Smartphone apps can improve accessibility by people to social support. This is a significant attribute in weight loss (University of Missouri-Columbia 2014). Therefore, this evaluation element should be included in weight loss and diet evaluation framework.

Thirdly, the ‘**Availability of knowledge resource**’ evaluation element was included as a result of the content analysis (see section 5.3.1). This element was present in three different studies. Consequently, it was regarded as an important element in evaluating



weight loss and diet apps. To support the content analysis, the literature was also reviewed. This element was included in Shigaki et al. (2014) research on weight loss. According to them, informational support is an important factor for the success of individual dieting. Therefore, this evaluation element should be included in weight loss and diet evaluation frameworks.

**‘Weight loss goal’** was the fourth element in the developed evaluation framework. The content analysis has revealed that this element was included in three studies (see section 5.3.1). In addition, the literature review has also revealed the importance of this element. According to the theory of intrinsic motivation (Ahtinen et al. 2009), displaying the progress towards a goal can provide support to a challenge as in the Wellness Diary app. Webber et al. (2010) states that weight loss intervention that is designed to improve motivation for weight loss including personal goal setting, assist in greater weight loss than a standard weight loss intervention. Goal setting is an autonomy supportive tool that could enhance autonomous motivation (Webber et al. 2010). Thus, including the attribute of weight loss goal was important, as it is one of motivational factors for using an app for a long time. Since it increases the motivation for weight loss and diet, **‘Weight loss goal’** evaluation element should be included in the evaluation frameworks.

The fifth evaluation element was **‘Regular physical activity’**. The reason for including this element in the framework, even though it was only involved in two of the studies (Breton et al. 2011 and Pagoto et al. 2013), was discussed in the previous chapter (section 5.3.1). The literature significantly supports physical activity in weight loss and diet. For example, a higher level of physical activity is better for long-term weight loss (The American Journal of clinical nutrition 2003). Regular physical activity and exercise reduce the risk of obesity (Thompson et al. 2003). Devotion to exercise may ultimately prove to be the cornerstone for long-term weight loss maintenance (Pronk and Wing 2012). Therefore, **‘Regular physical activity’** should be one of the evaluation elements of the weight loss and diet evaluation frameworks.

**‘Abstract and reflective’** was the sixth element for evaluating apps. It was included in the evaluation as it also was in the Alagöz et al. (2010) study. This was the main study used to identify the design of elements for wellness apps (section 5.3.2). According to Ahtinen et al. (2008), the wellness application should be able to visualise

and inform users of their progress. In the study of Ahtinen et al. (2009) to examine users' experience in three wellness applications, the authors discovered that the key motivating factor in one of the apps included in the study (Wellness Diary) was the graphs. These provided long-term information about users progress.

*“When people use information technology to support their weight-loss efforts, they tend to access features that provide visual feedback on their overall progress, like graphs showing weight lost over time”* (University of Missouri Columbia 2014).

Since ‘**Abstract and Reflective**’ is a key motivational element, it was necessary to include it in the evaluation frameworks.

The seventh element of the evaluation framework was ‘**Public**’. It was included in the evaluation as it was recommended by the wellness design strategies of Alagöz et al. (2010) (section 5.3.2). Ahtinen et al. (2009) states that there are four main factors related to the usability of health apps that promotes acceptance and distribution of such technology. These four factors are user-friendliness, usability, user competence, and confidence. Confidence is related to being confident with the system's performance and protecting users' data and its security (Ahtinen et al. 2009). Thus, as confidence is related to protecting users' data, it was considered one attribute of promoting wellness technology and its usability. The “public” feature covers the concept of confidence and thus it was needed to be in the framework.

Influenced by Alagöz et al. (2010) wellness apps design strategies, ‘**Aesthetic**’ element was included in evaluating the weight loss and diet apps (section 5.3.2). In addition, Ahtinen et al. (2009) claim that the user friendliness feature, which includes aesthetic presence and user interface, is one of the main factors that promote the use of and the acceptance of the wellness application. Therefore, the aesthetic element in the weight loss and diet evaluation framework was required.

‘**Controllable**’ was included in evaluating the weight loss and diet apps as advised by Alagöz et al. (2010) apps wellness design strategies (section 5.3.2). Ahtinen et al. (2008) point out that manual entering of data appears to increase users' control over the parameters entered. It also raises the awareness of the physical activity level. Manual entering can also eliminate the issue of error-prone , which could occur when a

user depends on sensory data. As manual data entry allows users a high level of controllability, it was recommended for inclusion in the evaluation framework.

**‘Trending / Historical’** was an element included in the study of Alagoz et al. (2010) (section 5.3.2). Ahtinen et al. (2009) found that the Wellness Diary app was among two different other wellness apps in their study, was the most motivating mobile app in the trial, as it provided information on the long-term progress of different aspects of wellness such as steps and weight. Therefore, since including the historical data in wellness application is a motivating factor that allows long-term use of app, it was appropriate for inclusion in the evaluation framework.

**‘Comprehensive’** was the last element in the evaluation framework which has been suggested by Alagoz et al. (2010) (section 5.3.2). The perceived value of the wellness application has been relatively low in short-term use when users depend only on manual data entry because it requires some effort (Ahtinen et al. 2009). Ahtinen et al. (2008) point out that automatic logging eliminates the perceived burden of logging from users and allows continuous logging. However, sensory entering of data could increase the entered data errors and reduce the user’s level of awareness of entered data (Ahtinen et al. 2008). Therefore, combining automatic and manual logging is required (Ahtinen et al. 2008). Hence, this concept was covered under the element of comprehensive as it considers the apps that allow users to manually enter data as well as collects sensory data as more accurate than apps that just provide one of these features. Thus, the existence of this element in a weight loss and diet evaluation framework was significant.

- **Initial Finding Four**

Figures 6.5 and 6.6 showed the frequency of occurrence for each of the evaluation elements in iOS and Android apps respectively. In the iTunes apps, all of the usability elements occurred at least in one app. However, in the Google Play apps, all of the usability elements were present in at least one app except the usability element of ‘Comprehensive’. ‘Comprehensive’ was the last element of the developed evaluation framework. It was previously defined and discussed in section 5.3.2. In addition, the previous discussion of the third initial finding showed the importance of each of the evaluation elements in weight loss and diet context including the comprehensive element. ‘Comprehensive’ is a significant attribute and it should be included in weight

loss and diet apps. However, despite the importance of the comprehensive attribute in weight loss and diet apps, it did not exist in any of the Google Play apps. The comprehensive strategy aimed to score an app on whether it allowed a user to manage data manually and whether it provided the option for collecting user sensory data. Despite of the importance of the sensory data in this context, where it can aid in collecting valuable information that relate to weight loss and diet such as collecting the distance of running. None of the Google Play apps included features related to collecting sensory data such as the GPS feature. Therefore, Google Play apps developers may need to include this feature in weight loss and diet apps to improve its usability.

- **Initial Finding Five**

The outcomes of applying the evaluation framework to the iTunes and Google Play apps showed that 18% of the evaluated apps out of the 51 apps achieved index scores equal the average score; the average index score was 5. While only 37% of the evaluated apps out of the 51 apps achieved index scores above the average, 45% achieved index scores below the average. The aforementioned outcome indicates that the proportion of the apps with index scores below the average is higher than the proportion of the apps with index scores above the average. This indicates that out of the 51 apps more of which gave index scores below the average rather than those apps that returned above average index scores. This implies that the top popular apps are not necessarily the most usable and effective apps. In fact, the popularity of apps may only be represented by the number of downloads. Furthermore, this finding supports the Initial Findings One and Two, as they both indicate that none of the iTunes and Google Play apps achieved the highest index score.

## 6.6 CHAPTER REFLECTION

This chapter has presented an overview of the apps evaluation process. Also, it has showed the outcomes achieved by applying the evaluation framework on iTunes and Google Play apps. Furthermore, it has demonstrated the frequency of existence of the evaluation framework elements. It has also showed a comparison resulting from the application of the developed evaluation framework on the iTunes and Google Play apps. Finally, it discussed five main initial findings given by using the evaluation framework on the iTunes and Google Play apps.

# Chapter Seven

# Thematic Analysis of User Reviews

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## 7. THEMATIC ANALYSIS OF USERS REVIEWS AND DISCUSSION OF INITIAL FINDINGS

### 7.1 INTRODUCTION

This chapter demonstrates the outcomes of analysing the apps user reviews. The apps user reviews analysis was conducted using deductive thematic coding (see section 3.8.2). Details regarding selecting the user reviews and undertaking the steps of the deductive thematic analysis can be found in Chapter Three, section 3.8.2.

- Section 7.2 demonstrates the number of apps user reviews that were analysed and presents the emerged categories that resulted from the analysis of the iTunes and Google Play apps user reviews. Analysing the user reviews revealed that some of the categories were directly related to the elements of evaluation framework and some were not.
- Section 7.3 demonstrates the frequency of emerged categories that related to the evaluation framework.
- Section 7.4 presents the existence of categories that related to elements of evaluation framework in iTunes and Google Play user reviews.
- Section 7.5 demonstrates a comparison between the outcomes of thematic analysis of apps user reviews and the outcomes of applying evaluation framework to the iTunes and Google Play apps.
- Section 7.6 presents a discussion of the main initial findings of the thematic analysis phase.

## 7.2 APPS USERS REVIEWS ANALYSIS USING DEDUCTIVE THEMATIC ANALYSIS

The following sections show the number of the analysed iTunes and Google Play user reviews. In addition, present the emerged categories that resulted from analysing the iTunes and Google Play apps users reviews using deductive thematic analysis. Analysing the categories revealed that some of the categories were directly related to the elements of the developed evaluation framework (see section 5.3) and some categories were not.

### 7.2.1 Number of Analysed Apps User Reviews

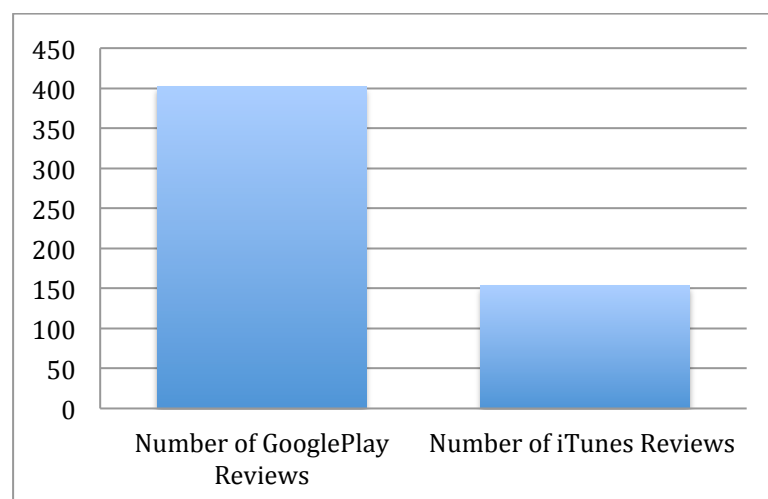
Many of the iTunes apps did not have user reviews. However, almost all the Google Play apps had user reviews. Thus, the number of user reviews significantly affected the outcomes of the analysis (see section 7.3, 7.4, and 7.5). The following table shows the number of analysed user reviews for both iTunes and Google Play apps.

**Table 7.1** The number of analysed user reviews of the iTunes and Google Play

Number of Google Play Reviews	Number of iTunes Reviews
402	153

The following figure demonstrates that there were a large difference between the number of apps user reviews for iTunes and Google Play apps.

**Figure 7.1** The difference between the number of analysed user reviews of the iTunes and Google play



### 7.2.2 Categories Related to the Elements of Developed Evaluation Framework

Analysing the iTunes and Google Play apps user reviews resulted in 11 categories directly related to the elements of the developed evaluation framework: *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive.*

**Related Categories** to the elements of evolution framework means that the themes of these categories were related in wording, or meaning to the elements of the evaluation framework (i.e. *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive*). Some of these related categories emerged as result of analysing iTunes and Google Play user reviews and some resulted from only one of them.

The main **Related Categories** that have been obtained from the analysis of the iTunes and Google Play apps user reviews are individually presented below, accompanied with the themes that were generated and used to support each category.

#### **Monitoring User Data**

*Monitoring User Data* refers to app when provides a mean for tracking users data in general and tracking weight/calorie across a period of time.

*Calories Tracking, Weight Tracking, Tracking, Eating & Food Tracking,* are the themes incorporated in this category. This category has emerged as result of iTunes and Google Play apps user reviews.

#### ***Calories Tracking***

*Calories Tracking* considers aspects of calorie tracking such as informing the user of the calories burned or remained, or showing the ability of the app to see user calories. This theme was presented in both iTunes and Google Play user reviews.



*[I use this app when walking my dogs. I haven't used its full features yet but so far it's fantastic. Tells me everything I want to know (Distance, calories burned, walking pace, etc.)...]* iTunes User Review.

*[Product list of foods has greatly improved. Keeps you aware of how many calories you are eating and how many calories you burn by your exercise]*  
Google Play User Review.

### **Weight Tracking**

*Weight tracking* considers aspects such as the app allowing the user to see start weight and end weight and the meaning of weight tracking. This theme was only present in Google Play user reviews.

*[Motivation Great app..to me its my motivation helps me keep track of my weight...]* Google Play User Review.

### **Tracking**

*Tracking* involves the aspect of tracking and monitoring in general. This theme was found in both iTunes and Google Play user reviews.

*[Helps to motivate you and keeps you on track. Love it.]* iTunes User Review.

*[Easy to use and good tracking options. The one thing I really wish though is that you could see things no matter...]* Google Play User Review.

### **Eating & Food Tracking**

*Eating & food Tracking* considers aspects of eating and food tracking and monitoring. This theme has presented in both iTunes and Google Play user reviews.

*[Really helps keep track of eating & cals. Help my focus too. I've recommended this to 6 people all who are using it]* iTunes User Review.

*[Love this app. Awesome way to keep track of calories, foods eaten, goals, weight loss, etc. The extensive food library is great, and easy to add to on the rare occasion that you don't find what you are looking for]* Google Play User Review.

### **Social Support**

*Social Support* refers to an app allowing users to access social support components like message boards, chat rooms, email an expert, or a networking component like Twitter and thus social contacting.

The theme *Forums* has presented in the category of Social Support for both iTunes and Google Play reviews. *Social Groups* and *Dashboard* have emerged in *Social Support* category of iTunes reviews. *Facebook*, *People Support System* and *Social App* have incorporated in Social Support category for Google Play reviews.

### ***Social Groups***

*Social Groups* include the term of social groups as well as considers the ability of app to allow social contacting between the groups members. This theme was only present in the iTunes user reviews.

[Great for group of friends would highly recommend] iTunes User Review.

### ***Dashboard***

*Dashboard* includes the term “dashboard”, which refers to social components that allow users to socially interact with each other. This theme was only present in the iTunes user reviews.

[Thank you. Easy to use graphing. Dashboard and love the push posts which let me do that bit more.] iTunes User Review.

### ***Facebook***

*Facebook* considers the term “Facebook”, which indicates the social components that allow users to socially interact and communicate using the Facebook. This theme was only present in the Google Play user reviews.

[Facebook!] Google Play User Review.

### ***People Support System***

*People Support System* considers the term “People Support System”, which refers to getting supports from the app users through social communication. This theme was only present in the Google Play user reviews.

*[Amazingly well put together. I love this app; the support system from people all over is real and kind I would recommend. Needs a notification to notify people of forum threads.]* Google play User Review.

### **Social App**

*Social App* considers the term “Social App”, which demonstrates the ability of an app to provide a social communication features. This theme was only found in the Google Play user reviews.

*[Just an Ad counting scam. No real point to this poor social fitness app. Mainly just a gateway for the m-points ad scam!]* Google Play User Review.

### **Forums**

*Forums* search for the term “Forums”, which indicates the social components that allow users to socially interact with other users. This theme was found in the iTunes and Google Play user reviews.

*[...it now allow me to show a graph of my weight on my Web page and in the signature of forum posts. This ability is scarily motivating. I can't hide from the flabby (but much thinner now thanks to this app) truth.]* Google Play User Review.

*[I love this app, it's really helping me. I also like the forum...]* iTunes User Review.

### **Knowledge Resource**

*Knowledge Resource* refers to an App providing a knowledge resource that can assist users of apps to increase knowledge/ information related to nutrition, and awareness of weight control or reduction. Tips, ideas, and advices related to nutrition, diet, weight loss all considered as it increases users knowledge.

The themes of *Recipes and Foods* and *Informative* has found in the iTunes and Google Play user reviews, while *Food Database*, *Library of Food* and *Nutrients* were themes incorporated in the iTunes user reviews.

### ***Food Database***

*Food Database* including the term “Food Database”. This theme was found in the iTunes user reviews.

*[This app is very easy to use, nice food database]* iTunes User Review.

### ***Library of Food***

*Library of Food* including the term “Library of Food”. This theme was found in the iTunes user reviews.

*[includes a huge library of food...]* iTunes User Review.

### ***Nutrients***

*Nutrients* involve searching for the term “Nutrients”. This theme was found in the iTunes user reviews.

*[Really like the detail with the number of nutrients covered and how extensive the database is.]* iTunes User Review.

### ***Informative***

*Informative* considers the term “Informative”, which refers to the ability of an app to provide nutrition information to users. This theme was found in the iTunes and Google Play user reviews.

*[This is a great app to use for information and learning about nutrition. It's easy to use, fast and useful. Well done. ]* iTunes User Review.

*[Great information]* Google Play User Review.

### ***Recipes and Foods***

*Recipes and Foods* theme considers the terms “recipes”, “meal/food ideas” and “food options”. This theme was found in the iTunes and Google Play user reviews.

*[Amazing app for the Australian market. Even includes lite and Easy recipes!...]* iTunes User Review.

*[I love this. This app was exactly what i was looking for. It has so many meal ideas and recipes and they are all simple!! Which is good because I cant cook at all...]* Google Play User Review.

### **Weight Loss Goal**

*Weight Loss Goal* refers to when an app recommends certain weight loss goals for their users, or allows a user to enter target weight. In addition, this category included reviews describing the meaning of weight loss.

*Losing Weight* and *Weight Loss Target* were themes in this category that has found in both iTunes and Google Play user reviews. *Setting Goals* was theme that has included in this category for iTunes user reviews only. *Calculating Weight* was emerged as result of analysing Google Play user reviews.

#### ***Losing Weight***

*Losing Weight* considers the term “Lose weight”, which refers to the assistance of an app in losing weight. This theme was found in the iTunes and Google Play user reviews.

*[This app has helped me track how far I am walking, the speed I am walking at and how long it takes to walk it... it's going to be a great help in my weight loss journey☺]* iTunes User Review.

*[Noom Lost so much weight because of "Noom" it's amazing.]* Google Play User Review.

#### ***Weight Loss Target***

*Weight Loss Target* involves searching for the terms “weight target” or “weight goal”. This theme refers to the ability of an app to allow specifying target weight loss. This theme was found in the iTunes and Google Play user reviews.

*[I have had this app for a little while but have only recently just started using it for more targeted weight loss. Love it! I had helped me be more accountable to my goals...]* iTunes User Review.

*[...isn't feasible then historical input would help. Motivates or reality check depending on movement. Definitely helping me in my target to loose weight but can see it helping those that need to gain too...]* Google Play User Review.

### **Setting Goals**

*Setting Goals* includes the ability of an app to set weight goals/targets and the search were for terms such as “set goal” and “set targets”. This theme was found in the iTunes and Google Play user reviews.

*[Help with setting targets-updates help with keeping target.] iTunes User Review.*

*[...Features but doesn't feel cluttered. Unfortunately, the "GOAL" tab under Profile ruins it for me. I entered my target weight during setup it said "Normal Weight" (165 lbs.), afterward it says "Obesity". Also, the percentages are wacky. My goal BMI is 327.3% and Fat is 394%. I'm 5' 11", that's unlikely.] Google Play User Review.*

### **Calculating Weight**

*Calculating Weight* includes the term “calculating weight” and “calculating BMI”. This theme was found in the Google Play user reviews.

*[...For me bodyfat is more important than weight and this tracks and charts both. Also tracks cheat days and workout days plus other important things plus has the notes option and calculates your BMI. Its very nice.] Google Play User Review.*

### **Regular Physical Activity**

*Regular Physical Activity* refers to when an app recommends a certain amount of a physical activity or when apps allow users to log a regular physical activity.

There were two themes constructed this category. *Exercise Tracking* was a theme that only emerged when analysing iTunes and Google Play user reviews. The *Managing Physical Exercises* theme arose as result of analysing Google Play user reviews.

### **Exercise Tracking**

*Exercise Tracking* includes the term “exercise/s” “exercise tracking”, which indicates the ability of an app to track exercises. This theme was found in the iTunes and Google Play user reviews.

*[I started the app for the first time as I headed out the door for my walk. I had it up and running within seconds. It gave me updates as I walked ...]*  
iTunes User Review.

*[One of the best apps on my phone. Tracks your workouts, calories, distances and speed...]* iTunes user review

*[Samsung Galaxy s4 Love this app I like the challenges you can keep a track of how many times you exercise each day. I also love dressing my avatar.]*  
Google Play User Review.

### ***Managing Physical Exercises***

*Managing Physical Exercises* considers the term “manage physical exercise”. This theme was found in the Google Play user reviews.

*[...Good App I recommend you who want to lose some weight to download this app. it's so great to know your fat body so you can manage physical exercise if you want to do so. rate 4 not 3 because it's free...].* Google Play User Review.

### **Abstract and Reflective**

*Abstract and Reflective* is concerned with if an app provides a graph; chart or other virtual mean to easily reflect the data of the user and allow the user to clearly see his/her progress in a more abstract and reflective way.

*Graphs* was the only emerged theme that constructed the Abstract and Reflective category as result of analysing both iTunes and Google Play user reviews.

### ***Graphs***

*Graphs* consider the term “graph/s” or other similar words. This was an indication of availability of visual representation in an app. This theme was found in the iTunes and Google Play user reviews.

*[Thankyou. Easy to use graphing. Dashboard and love the push posts which let me do that bit more]* iTunes User Review.

*[Gorgeous! This app is beautiful. From it's minimalist design to the informative, easy to interpret graphs I wouldn't change a thing.]* Google Play User Review.

### **Public**

*Public* refers to the ability of an app to provide a login feature or something similar that allows users to enter a password to avoid unwanted disclosure of their personal data. For example, pin code.

*Public* was not found in iTunes reviews as there were no themes that related to this category in meaning or in wording. However, there were two themes related to this category in Google Play apps reviews: *Logging In*, and *Pin Code*.

### ***Logging In***

*Logging In* includes the term “log in”, or “logging in”. The theme indicates an app provides log in feature. This theme was found in the Google Play user reviews.

*[Greatness! I love it and have been on it for 2 years plus. Got a nice streak going and lost a lot of weight! Buggy here and there but doesn't stop me from logging in and updating.]* Google Play User Review.

### ***Pin Code***

*Pin Code* includes the term “pin code” which is an indication of the availability of entering a pin code feature in an app. This theme was found in the Google Play user reviews.

*[Great app Love that you can add a pin code! ]* Google Play User Review.

### **Aesthetic**

*Aesthetic* refers to an app enabling a user to customise or adapt some features in the app according to the user’s personnel preferences. The customisability could be meaning or words indicate the customisability or something similar.



*Aesthetic* did not exist in iTunes user reviews, as there were no themes related to this category. However, there were two themes in Google Play user reviews that allowed the construction of this category: *Changeable Avatar*, and *personalised and Customisable*.

### ***Changeable Avatar***

*Changeable Avatar* indicates the ability of an app to change the app avatar. This theme was found in the Google Play user reviews.

[*Samsung Galaxy s4 Love this app I like the challenges you can keep a track of how many times you exercise each day. I also love dressing my avatar.*]  
Google Play User Review.

### ***Personalised and Customisable***

*Personalised and Customisable* implies that an app allow users to customise and personalise some features in the app. This theme was found in the iTunes and Google Play user reviews.

[*Good, but could be better. It has a lot of great content and functionality - I love that you can customize your home screen! But a little clunky and slow.*]  
iTunes User Review.

[*Love the Improvements With a personalized goal board and an easy to use food tracker, I love using this app. It helped me lose 16 pounds. The great articles help keep me going.*]  
Google Play User Review.

### **Controllable**

<p><i>Controllable</i> refers to an apps ability to allow the user in entering, managing and controlling access to data. Reviews included the word “control”, or anything similar in meaning such as editing, entering, or managing data.</p>
---

*Searching Data* was one of themes that found in iTunes user reviews that enabled the building of the Controllable category. *In Control* was a theme that emerged as result of analysing Google Play user reviews. The *Entering Data* theme was found in both iTunes and Google Play User Review.

### ***Searching Data***

*Searching Data* refers to the ability of an app to enable users to search or select data. This theme was found in the iTunes user reviews.

*[Only used it for a day so far, but all seems pretty good. I like the integrated calorie watch where you can add in meals either by their barcode or by searching the name. Alternatively you can manually add the information]*  
iTunes User Review.

### ***Entering Data***

*Entering Data* includes the ability of an app to enable users to enter data. This theme was found in the iTunes and Google Play user reviews.

*[I needed an app that I could input food and it would record the protein, carbs & fats for an all up calorie count- it's a good prompt to eat a particular food...]* iTunes User Review.

*[Love it!! I enter everything I've eaten, exercise I've done and the amount of water I've drank. I've only been doing it a couple of days and already lost a few lbs!]* Google Play User Review.

### ***In Control***

*In Control* indicates that users can have some control over some feature in an app to a certain limit. This theme was found in the Google Play user reviews.

*[Useful tool to keep track of one's weight. Once the weight is put to check, it gets under control ;) eating less helps]* Google Play User Review.

### **Trending and Historical**

*Trending and Historical* refers to ability of an app to allow a user to access historical data to show changes and trends. I.e. gives history or diary. The history could concern with weeks, months, or years.

This category included three themes: *Times Tracking*; that emerged as result of analysing iTunes reviews; *Diary*, which was found in both iTunes and Google Play reviews.

### ***Times Tracking***

*Times Tracking* indicates the ability of an app to track times. This theme was included in the iTunes user reviews.

*[Great app to get track of your times...] iTunes User Review.*

### ***Diary***

*Diary* means the availability of an in-app-diary, calendar. This theme was found in the iTunes and Google Play user reviews.

*[I have done weight watchers before and you need to ave books with you etc, but I find this diary so easy to use!!... Thanks for making such a gret diary]*  
iTunes User Review.

*[So nice Love this app. It counts my calories. And have a diary and forums. All I need.]* Google Play User Review.

*[Love it Newly installed so haven't encountered bugs yet but I LOVE the calendar history. I'm always wondering what weight I could be at a certain time if I stay on track and this is the only app I've seen that can show you clearly. Other great things as well]* Google Play User Review.

### **Comprehensive**

*Comprehensive* refers to ability of an app to allow users to collect user sensory data.

This category was not found in Google Play user reviews. However, it emerged in iTunes user reviews in one main theme named *GPS* (Global Positioning System), which enables the collection of sensory data.

### ***GPS***

*GPS* considers the availability of GPS function in an app. This theme was only included in the iTunes user reviews.

*[...I had it up and running with seconds.It gave me updates as I walked and I could pause it to engoy the view and preathe...] iTunes User Review.*

### 7.2.3 Categories Unrelated to the Elements of Developed Evaluation Framework

Analysing the iTunes and Google Play apps reviews has resulted in 12 categories that were not related to the elements of the evaluation framework: *Synchronisation, Feelings, Bar code Scanning, Usable for All, Reminder, Annoying Ads, Motivation, Improvement Suggestions, App Cons, App Pros, Ease of Use, and Recommended.*

**Unrelated Categories** to the elements of the developed framework means that the themes of these categories were not related in wording or meaning to the elements of the evaluation framework (i.e. *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive*). Some of these unrelated categories emerged as result of analysing both iTunes and Google Play user reviews and some resulted from only one of them.

The unrelated categories that have been found from analysing the iTunes and Google Play apps user reviews are individually presented below, accompanied by the themes that were generated and used to support each category.

#### **Synchronisation**

*Synchronisation* refers to the ability of an app to sync to other apps or system to add extra functionally to the app function.

This category was found as result of analysing iTunes and Google Play user reviews. *Syncing* is the only theme that emerged in both iTunes and Google Play User Reviews.

#### ***Syncing***

*Syncing* theme refers to the ability of an app to sync to other apps or system to add extra functionally to the app function. This theme was found in the iTunes and Google Play user reviews.

*[I love my fitbit. Have it synced with myfitnesspal and loving this. Giving me the motivation to exercises and get out and walk!...].* iTunes User Review.

*[Great app that syncs perfectly. I use this app to count my calories whilst it syncs perfectly with runtastic pro to monitor my exercise. The only downside is there is no paid version to get rid of the ads.]* Google Play User Review.

### **Feelings**

*Feelings* refer to the ability of an app in concerning user feelings or enabling user to express their feelings.

This category was found only in Google Play user reviews. *Feelings* considers the term “feelings” that indicates that an app is enabling users to express their feelings. The main theme that emerged was named ***Feelings***. This theme was only emerged as result of analysing Google Play user reviews.

*[Good and it comes so handy. I love the diary part where I could write down my feelings.]* Google Play User Review

*[Love this app. Keeps me on track and helps me write goals that I can attain and achieve. Motivation is so helpful for day-to-day feelings or events.]* Google Play User Review.

### **Bar code Scanning**

*Bar Code Scanning* refers to ability of an app to provide a bar code scanning tool to allow user to scan, add food and products.

This category was found as result of analysing both iTunes and Google Play user reviews. The main discovered theme was named ***Bar Code Scanning***. *Bar Code Scanning* cover the terms “bar code scan”, “barcode”, “barcode reader” and “bar code scanner”, which were an indication of the ability of an app to provide bar code scanning functionality. This theme was found in the iTunes and Google Play user reviews.

*[...The barcode reader is simply a genius feature for tis kind of tool...]* iTunes User Review.

*[Updated Fitness Pal Easy to add both food and exercise to keep on track with goals. Love the bar code scanner option for adding foods.]* Google Play User Review.

### **Usable for All**

*Usable for All* refers to the suitability of an app to a wide variety of individuals. The app can be used in different languages, suits women and men, suits people with special needs (e.g. individuals with diabetes, pregnant women), and includes different products, diet plans and foods suitable for different people.

This category emerged in both iTunes and Google Play user review. *Suitable for All* was the main and only theme in this category.

### ***Suitable for All***

This theme concerned with the suitability of an app to a wide range of individuals. The suitability of an app to a wide range of users seems to be an important aspect in diet apps as a number of users have expressed their concerns about it. This theme was emerged from the iTunes and Google Play user reviews.

*[It has only American products so when you are looking up products or trying to scan you can't find the correct product...]* iTunes User Review.

*[It's fine Adequate for my needs and covers a variety of different exercise needs for different people's lives.]* Google Play User Review.

### **Reminder**

*Reminder* refers to the existence of a reminding or alarming function. The ability of an app to remind user to do workouts, eat certain meals are examples of this.

This category was found in both iTunes and Google Play user reviews. The main theme was *Alarms and Reminders*.

### ***Alarms and Reminders***

*Alarms and Reminders* includes the terms “reminder/s”, and “alarm/s”, which indicate the ability of an app to remind users such as performing workouts or to use the app. This theme was emerged from the iTunes and Google Play user reviews.

*[Great app that helps you lose weight and stay on track with reminders...]*

iTunes User Review.

*[Productive! It really helps with keeping track of the little things. I like that it has alerts and reminders.]* Google Play User Review.

### **Annoying Ads**

*Annoying Ads* refers to a lot of pop up ads that are stated to annoy users.

This category was established as it was found in both iTunes and Google Play user reviews. The main theme involved in this category is named ***Annoying Ads***. Pops up ads were described as upsetting and frustrating to users and typically were labeled as annoying ads. This theme was emerged from the iTunes and Google Play user reviews.

*[Even when you make an in app purchase it still bloated with ads...]* iTunes User Review.

*[Waste of time So much ads, very annoying and irritating...]* Google Play User Review.

### **Motivation**

*Motivation* refers the ability of an app to motivate users in improving healthy habits such as workouts, healthy eating, improving sleeping habits.

This category emerged as result of analysing both iTunes and Google Play user reviews. The theme incorporated in this category was named ***Motivation***. The reviews reflected that many users like to be motivated by apps to improve their health habits.

*[Great App I'm not one who is easily motivated since failure has plagued me for too long, but this app has given me just the right push to reach my goals. Very simple. Prefect design.]* Google Play User Review.

*[...Easy interface and motivational. Iust wish you could post at least 1 pic in the free version]* iTunes User Review.

### Improvement Suggestions

*Improvement Suggestions* refers to suggestions and ideas from app users to improve the app functionality, or design

This category was found in both iTunes and Google Play apps user reviews. The theme involved in this category is named ***Improvement Suggestions***. Reviews reveal that several users gave app suggestions and ideas to improve app functionality or design. Paying attention to such theme by apps developers could assist in apps improvements.

[...*Requires a log in*] iTunes User Review.

[*This is a really nice app. They should put the SWORKIT app in there or an app exercise option*] Google Play User Review.

### App Cons

*App Cons* refers to the weaknesses and difficulties found in the apps. In addition, negative expressions (e.g. “useless”, “garbage”) considers within app cons.

The *App Cons* category emerged from reviews in both iTunes and Google Play expressing app weaknesses and difficulties or negatively describing an app. The main theme involved in this category was ***App Cons***. Detailed investigation of this theme can aid developers to improve apps by overcoming the app limitation and can also notify users about apps weaknesses.

[*Looks like a great app just won't stay open shame*] iTunes User Review.

[*Rubbish Useless, every button you press causes an advert to pop up. You can Beaully use this junk. You can't Change the units.*] Google Play User Review.



### App Pros

*App Pros* refers to the strength and advantages found in the apps. Positive expressions (e.g. “great”, “wonderful”...etc.) all includes within App Pros.

This category involves the *App Pros*. It was embedded in iTunes and Google Play user reviews. The theme name ***App Pros***. It includes apps strength, pros of app and positive expressions that describing an app.

[*Awesome*] iTunes User Review.

[*...So far, Awesome! This app is very well developed and seems to look out for the best interest of the user,...*] Google Play User Review.

### Ease of Use

*Ease of Use* refers to the ease of use of an app and what proportion of the use is simple.

The *Ease of Use* category has grown, as there were reviews in both iTunes and Google Play user reviews relating to the ease of use and the simplicity of app. The main theme incorporated in this category named ***Ease of Use***.

[*Very easy to use ...*] iTunesUser Review.

[*I love this app It is very easy to use and it keeps up with everything :)...*] Google Play User Review.

### Recommended

*Recommended* refers to recommending apps to others to use it as it is considered worth using.

The *Recommended* category was only found in iTunes user reviews and only includes one theme, named ***Recommended***.

[*...I recommended to my family and friends.*] iTunes User Review.

### **7.3 FREQUENCY OF EMERGED CATEGORIES RELATED TO THE EVALUATION FRAMEWORK**

The philosophical stance of this research is a subjective ontology and an interpretive epistemology (see chapter 3, section 3.4). For the second stage of this research, a qualitative content analysis was employed in the development of the evaluation framework. Elements for potential inclusion were determined through an analysis of literature, and the number of times the elements could be reflected in other studies. In stage three, the user reviews of the apps were examined by deductive thematic analysis. This process generated a number of categories that were directly reflected in the framework and categories that held no relation to the framework elements.

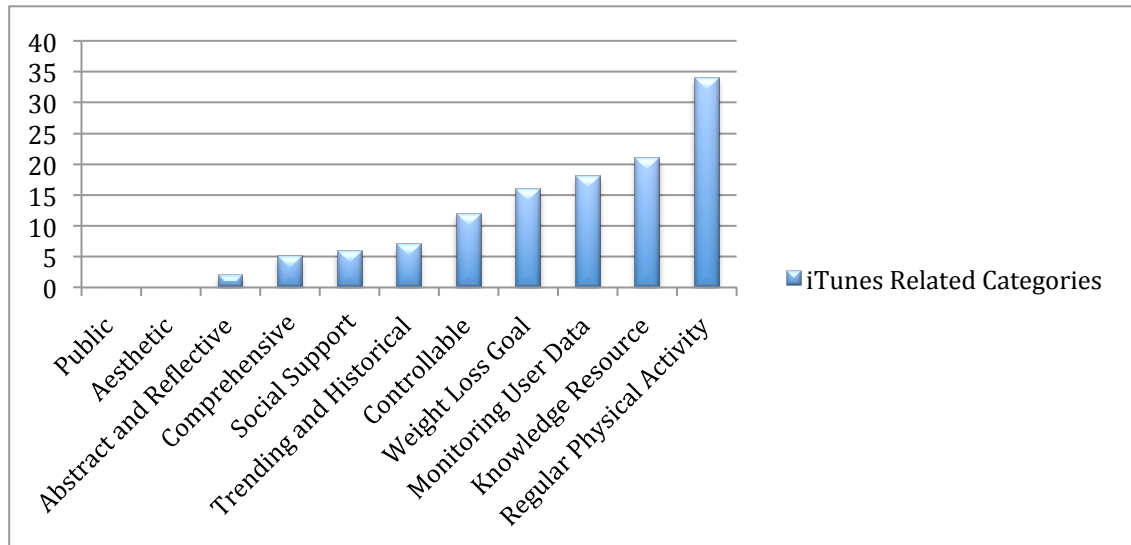
The *Related Categories* developed from the thematic analysis enriched the research by introducing a user point of view towards the framework that had been initially generated through the available literature. As the content analysis used a quantitative element as a part of the rationale for inclusion of the ultimate framework elements, the *Related Categories* were counted which is accordingly viewed in the same manner. However, the *Unrelated Categories* developed from the thematic analysis added additional insight and meaning to the apps ranking in the framework. These *Unrelated Categories* were formed, as the interpretative nature of the research did not discount that had emerged from the user reviews, regardless of the potential relation to the framework. The mere existence of any unrelated category was deemed to be relevant. Accordingly, the *Unrelated Categories* were not ranked or order through any type of quantitative measure. This distinction between the analysis of the *Related* and *Unrelated Categories* is in line with the philosophical nature of this research.

#### **7.3.1 iTunes Apps User Reviews**

As stated earlier in this chapter, there were 153 users' reviews that were analysed in the iTunes apps. Through the thematic analysis, the main themes of users' reviews were organised into two broad categories: *Related Categories* that directly related to the eleven elements of the evaluation framework; and *Unrelated Categories* that were not related to the evaluation framework elements. Figure 7.2 shows the occurrence of categories related to the evaluation framework elements. While the category of regular physical activities was noted 34 times in iTunes apps user reviews, the categories of

public and aesthetic were not observed in any of the users' reviews. Categories related to other evaluation elements were present in the iTunes user reviews twice or more.

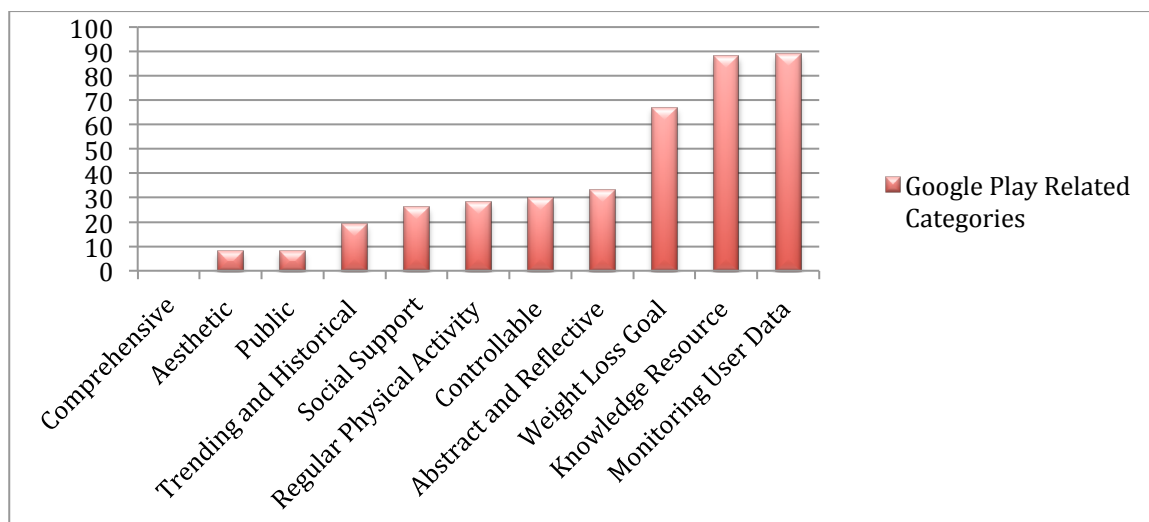
**Figure 7.2 Frequency of occurrence of emerged iTunes Categories related to evaluation framework**



### 7.3.2 Google Play Apps User Reviews

The thematic analysis of 402 Google Play apps user reviews has revealed categories that were related to the evaluation frameworks elements and other categories that were not related. *Comprehensive* was the only evaluation framework element that was not observed in the reviews. The three evaluation framework elements that were most frequently observed were *Monitoring User Data*, *Knowledge Resources* and *Weight Loss Goal*. Categories related to other evaluation elements were present eight times or more.

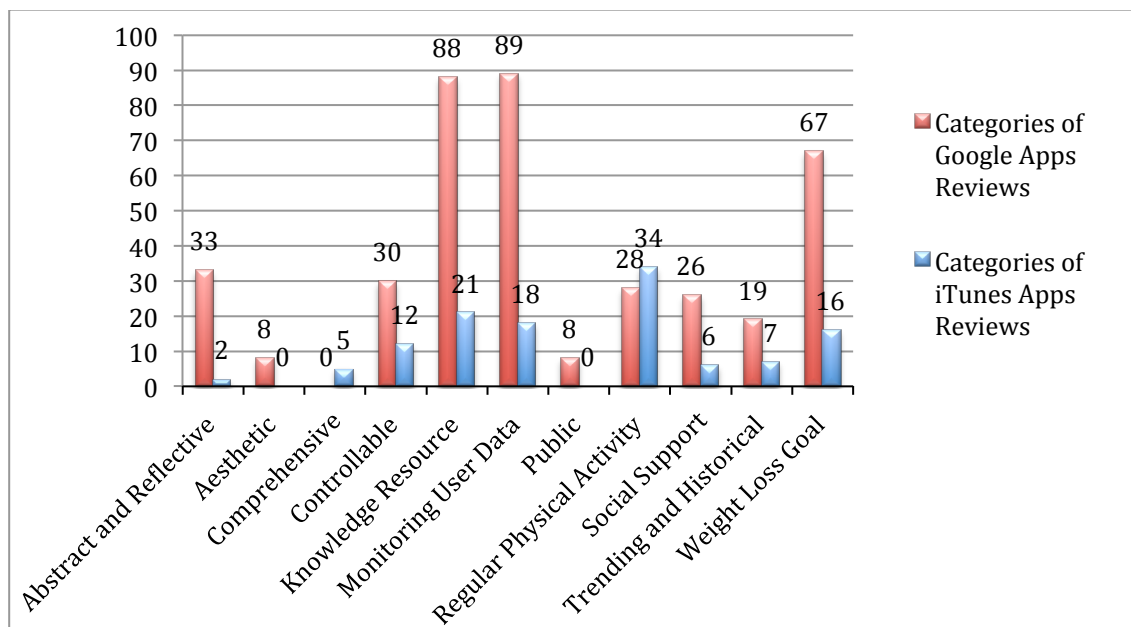
**Figure 7.3 Frequency Of Emerged Google Play Categories Related To Evaluation Framework Elements**



### 7.3.3 Comparison of Related Categories of iTunes and Google Play Apps User Reviews

While the thematic analysis covered 402 user reviews for Google Play apps, only 154 reviews were found for iTunes apps for the same period. As a result, the categories that related to the evaluation framework elements were more frequently found in Google Play apps user reviews than in the iTunes apps user reviews. The *Comprehensive* category was the only element not found in the Google Play user reviews, whereas two categories, *Aesthetic* and *Public*, were not found in the iTunes apps user reviews. The frequency with which the categories related to *Abstract And Reflective*, *Controllable*, *Knowledge Resource*, *Monitoring User Data* and *Weight Loss Goal* occurred in the Google Play apps user reviews greatly exceeded those found in the iTunes apps user reviews. The largest differences occurred in the categories of *Monitoring User Data* and *Knowledge Resource*. While categories related to *Monitoring User Data* were present 89 times in Google Play apps user reviews, they occurred only 18 times in iTunes apps user reviews. In contrast, the category of *Regular Physical Activity* was found in more iTunes apps user reviews than Google Play user reviews. It has occurred 34 times in iTunes user reviews compared with 28 times in Google Play reviews. Therefore, since there were more user reviews of Google Play apps than iTunes apps, it was reasonable that more categories relating to the evaluation framework elements emerged in Google Play user reviews than iTunes user reviews (See figure 7.4).

**Figure 7.4 Comparison Of Emerged Categories Related To Evaluation Framework Elements Between Google Play User Reviews and iTunes User Reviews**



## 7.4 PRESENCE OF CATEGORIES RELATED TO EVALUATION FRAMEWORK ELEMENTS IN iTunes AND GOOGLE PLAY APPS USER REVIEWS

Tables 7.2 and 7.3 show respectively the thematic categories that were related to the evaluation framework elements that were found in the iTunes and Google Play apps, based on analysing the users reviews.

**Table 7.2 Elements existed in iTunes apps user reviews related to the evaluation framework**

App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Reflective	Abstract and	Public	Aesthetic	Controllable	Historical	Trending/	Comprehensive
1. My Diet Coach- Weight Loss for Women													
2. Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution					X								
3. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss	X			X	X					X	X	X	
4. Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast													
5. Weight Loss Hypnosis by Mindifi- Lose Fat with Better Health and Meditation													
6. Calorie Counter & Diet Tracker by MyFitnessPal	X	X		X							X		
7. Nutricise-Meal Planner & Weight Loss Programs			X										
8. Nexercise- motivation to lose weight, to finally meet your weight loss & health goals		X			X								
9. TactioHealth (Weight Loss, Fitness, Hypertension & Diabetes Family eHealth Tracking System)													
10. Happy Scale: Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log	X												
11. Walkmeter GPS Pedometer- Walking Running Hiking for weight Loss Walk Tracker					X								
12. Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss		X			X								
13. Low Fat Recipes- Diet, Lose Fat, Lose Weight			X										
14. Australian Calorie Counter- Easy Diet Diary	X			X	X					X	X		
15. MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health	X			X	X	X				X			
16. My Diet Diary- Your Personal Calorie Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking				X	X								
17. Calorie Counter and Diet Tracker by Calorie Count		X											
18. I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet													
19. Belly Fat Workout Free-10 Minute Ab Exercises													
20. Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter		X	X		X					X		X	
21. CalorieKing Australia Food Search			X										
22. Nutrition Quiz: 600+ Facts, Myths & Diet Tips for Healthy Living			X										
23. Fitbit		X		X	X	X				X		X	
24. Ab Trainer X Free- Six- Pack Abs Exercises					X								

Table 7.3 Elements existed in Google Play apps user reviews related to the evaluation framework

App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Abstract and reflective	Public	Aesthetic	Controllable	Trending/Historical	Comprehensive
1. Noom Weight Loss Coach	X	X	X	X	X				X		
2. BMI Calculator -Weight Loss				X					X		
3. Diet Assistant - Weight Loss	X	X		X		X			X	X	
4. My Diet Coach - Weight Loss			X	X	X			X			
5. Diet Point · Weight Loss	X	X		X					X		
6. Monitor Your Weight	X	X		X		X	X		X	X	
7. Nexercise = fun weight loss	X	X							X		
8. Weight Loss Tracker - RecStyle	X			X		X		X			
9. BMI Calculator - Weight Loss									X		
10. Simple Weight Recorder				X		X				X	
11. Diets for losing weight											
12. Effective Weight Loss Guide			X		X						
13. Valentine's Weight Loss											
14. Weight Loss & Healthy Foods			X								
15. Weight control		X									
16. Weight War	X								X		
17. Weight Diary	X			X		X	X		X	X	
18. Weight Track Assistant	X			X		X			X	X	
19. Calorie Counter - MyFitnessPal	X	X		X	X	X	X		X	X	
20. My Diet Diary Calorie Counter		X	X	X	X				X	X	
21. Diet Plan			X		X	X					
22. Diet Diary (Diet Calendar)											
23. Photo diet											
24. Point by Point - Diet Lite											
25. Calorie Counter & Diet Tracker	X	X	X	X	X	X	X	X	X		
26. 10 Best Weight Loss Diet Plans			X								

## 7.5 COMPARISON OF THE CONTRIBUTIONS OF THE THEMATIC ANALYSIS AND THE PRACTICAL APPLICATION OF THE EVALUATION FRAMEWORK

This section examines whether the thematic analysis of users reviews matches the elements of evaluation framework for each app that have obtained earlier in Chapter 6 section 6.2. In other words, comparing the *Index Score values* gained by each app, when applying the developed evaluation framework, with the existence of *Related Categories* observed in the users' reviews.

Table 7.4 shows the iTunes apps index score values achieved by applying the evaluation framework with the number of related categories found based on analysing users' reviews for each app.

**Table 7.4 Comparison Between iTunes Apps Index Scores Values and The Number Of Related Categories Found In The iTunes Apps Users' Reviews.**

iTunes App Name	Index Score Values Gained When Applying Framework	Number of Related Categories Found in The Reviews
My Diet Coach- Weight Loss for Women	5	0
Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution	4	1
Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss	8	6
Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast	1	0
Weight Loss Hypnosis by Mindifi- Lose Fat with Better Health and Meditation	0	0
Calorie Counter & Diet Tracker by MyFitnessPal	8	4
Nutricise-Meal Planner & Weight Loss Programs	6	1
Nexercise- motivation to lose weight, to finally meet your weight loss & health goals	5	2
TactioHealth (Weight Loss, Fitness, Hypertension & Diabetes Family eHealth Tracking System)	8	0
Happy Scale:Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log...	5	1
Walkmeter GPS Pedometer- Wlaking Running Hiking for weight Loss Wlak Tracker	4	1
Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss	2	1
Low Fat Recipes- Diet, Lose Fat, Lose Weight	1	1
Australian Calorie Counter- Easy Diet Diary	6	5
MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health	7	5
My Diet Diary- Your Personal Calorie Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking	5	2
Calorie Counter and Diet Tracker by Calorie Count	7	1
I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet (© 2013 I feel Good Pty Ltd)	1	0
Belly Fat Workout Free-10 Minute Ab Exercises (©procodemedia.com 2012)	2	0
20. Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter (© 2014 MapMyFitness Inc)	5	5
CalorieKing Australia Food Search (© CalorieKing Wellness Solutions, Inc.)	1	1
Nutrition Quiz: 600+Facts, Myths & Diet Tips for Healthy Living	2	1
Fitbit	8	6
Ab Trainer X Free- Six- Pack Abs Exercises & Workouts	1	1
Best Diet Foods- how to keep fit with diet	3	0

It appears from Table 7.4 that the number of related categories recognised from analysing iTunes apps user reviews fairly closely match the index score values obtained by employing the evaluation framework. In five of the iTunes apps, the number of related categories found by analysing the user reviews is similar to the apps index score values awarded when applying the evaluation framework to apps. In nine iTunes apps, the numbers of related categories observed through analysing the users reviews were quite similar to the index scores obtained by applying the evaluation framework but with one to two elements different. Eleven apps had more than two elements difference between their gained index score values and the number of related categories found from analysing the user reviews.

In addition, table 7.5 compares the Google Play apps index score values, achieved by applying the evaluation framework, with the number of related categories found based on analysing the Google Play apps user reviews for each app. It appears from table 7.5 that the number of related categories that were recognised from analysing the user reviews closely matched the index score values. In eleven of the Google Play apps, the number of related categories, found through analysing the user reviews matched exactly the index score values obtained by applying the evaluation framework. In eight apps out of the 26 Google Play apps, the number of related categories found in the user reviews was close to the index score values with one or two elements missing. The remaining six apps had a difference of more than two elements.

To sum up, as there were more reviews of the Google Play apps than iTunes apps, a larger number of related categories were found in the Google Play user reviews when the reviews were analysed. Therefore, in the Google Play apps, the index score values matched the number of found related categories more closely than in the iTunes apps.



**Table 7.5 Comparison between Google play apps Index Scores Values and the number of Related Categories found in the Google play apps users' reviews.**

Google Play App Name	Index Score Value	Number of Evaluation Framework Elements Found in The Reviews
Noom Weight Loss Coach	8	6
BMI Calculator -Weight Loss	2	2
Diet Assistant - Weight Loss	6	6
My Diet Coach - Weight Loss	5	3
Diet Point · Weight Loss	4	4
Monitor Your Weight	6	6
Nexercise = fun weight loss	5	3
Weight Loss Tracker - RecStyle	5	4
BMI Calculator - Weight Loss	1	1
Simple Weight Recorder	4	3
Diets for losing weight	2	0
Effective Weight Loss Guide	3	2
Valentine's Weight Loss	0	0
Weight Loss & Healthy Foods	2	1
Weight control	6	0
Weight War	6	2
Weight Diary	6	6
Weight Track Assistant	6	5
Calorie Counter - MyFitnessPal	8	8
My Diet Diary Calorie Counter	5	5
Diet Plan	6	3
Diet Diary (Diet Calendar)	4	0
Photo diet	6	0
Point by Point - Diet Lite	3	0
Calorie Counter & Diet Tracker	9	9
10 Best Weight Loss Diet Plans	1	1

## 7.6 DISCUSSION OF INITIAL FINDINGS

The thematic analysis of iTunes and Google Play user reviews has resulted in many outcomes. This section discusses the main initial findings from the thematic analysis phase.

- **Initial Finding One**

As previously shown in this chapter, analysing the iTunes and Google Play apps user reviews has resulted in 11 categories directly related to the elements of the developed evaluation framework. *Related Categories* to the elements of evaluation framework means that the themes of these categories that constructed the categories were related in wording or meaning to the elements of the evaluation framework (i.e.

*Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive*). Some of these **Related Categories** emerged as the result of analysing both iTunes and Google Play user reviews and some resulted from only one of them (details in section 7.2.2). The 11 **Related Categories** are: *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive*. The presence of these 11 categories was an indication of the existence of all elements of the evaluation framework in the apps. To illustrate, all the eleven thematic categories were related to the identified evaluation elements of the developed framework. This indicates that none of the identified evaluation framework elements were irrelevant or inappropriate. This initial finding is consistent with the initial finding three that was previously discussed in chapter 6.

- **Initial Finding Two**

As previously presented in this chapter, analysing the iTunes and Google Play apps reviews has resulted in 12 categories that were not related to the elements of the evaluation framework: *Synchronisation, Feelings, Bar code Scanning, Usable for All, Reminder, Annoying Ads, Motivation, Improvement Suggestions, App Cons, App Pros, Ease of Use, and Recommended*. **Unrelated Categories** to the elements of evolution framework mean that the themes of these categories were not related in wording, or meaning to the elements of the evaluation framework (i.e. *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive*). Some of these **Unrelated Categories** emerged as result of analysing both iTunes and Google Play user reviews and some resulted from only one of them (details in section 7.2.3).

The *App Cons, App Pros, Improvement Suggestions, Recommended, Annoying Adds, and Feelings* (definitions in section 7.2.3) **Unrelated Categories** were less relevant than other discovered **Unrelated Categories** due to the following reasons:

The *App Cons*, and *Improvement Suggestions* are considered to be less relevant **Unrelated Categories** as the content of these categories could help the apps developer only and additional investigating them was beyond the scope of this research. To

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illustrate, *App Cons*, and *Improvement Suggestions* categories could result in improving the apps performance if took into account when developing and designing weight loss and diet apps.

The *Recommended*, and *App Pros* categories could be utilised by users who wants to know the most advised apps for them to use as the *Recommended* category demonstrated the recommendation of using the apps. Surplus investigation of *App Pros* category could show the advantages and pros of each app. Thus, it could be more meaningful for users. In addition, it would not useful to be added in the evaluation framework for weight loss and diet apps. Thus, detailed investigation of these categories is seen as beyond the scope of this research.

The *Annoying Ads* category informs the developers of the real issue of the extensive pop up Ads in free apps, which is that it may result in the alienation of users, discouraging them from using wellness apps. According to Pocatilu (2011), free smartphone apps need Internet connection for producing advertisements. Popular free smartphone apps include many advertisements (ScienceDaily 2012). Distracting ads are arriving in Android apps (Cassavoy 2012). Additional investigation in this category is out of the research aims. Including this element into the weight loss and diet framework is not required. However, it would benefit developers if they took these findings into account when designing wellness apps.

*Feelings* was of the less relevant found *Unrelated Categories*. The theme of this category was named “*Feelings*” (see section 7.2.3). The following are the two examples of raw data from the user reviews that included this theme:

[*I love the diary part where I could write down my feelings.*]

[*helpful for day-to-day feelings or events.*]

Google Play User Reviews.

The first user review shows that the diary is the part that allows the user to record feelings. The second indicates the helpfulness of the app in day-to-day feelings. Although this theme has emerged as result of analysing Google Play user reviews, *Feelings* was also one of the less relevance discovered *Unrelated Categories* as it only resulted from analysing Google Play apps user reviews, none of which were linked with

high index score values. Instead, it was associated with the apps user reviews with a low index score values. It was found in the following apps: “My Diet Coach - Weight Loss” and “Weight Track Assistant”. *Feelings* might be an attribute that could add further dimension in using an app. However, based on the developed evaluation framework, it was considered a non-major attribute that should not require to be in weight loss and diet apps and thus evaluation framework.

The *Ease of Use*, *Reminder*, *Bar Code Scanning*, *Motivation*, *Usable for All*, and *Synchronisation* (definitions in section 7.2.3) ***Unrelated Categories*** were in scope of this research and relevance more than other discovered ***Unrelated Categories*** as they were found in the user reviews of apps that achieved high index score values. The existence of these categories in the high index score user reviews reflects the importance of these elements in health apps, particularly weigh loss and diet apps. They were mainly found in the user reviews on the following apps:

1. Calorie Counter - MyFitnessPal,
2. Calorie Counter & Diet Tracker by spark people.
3. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss,
4. MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health,
5. Fitbit

The *Ease of Use* category besides it was emerged as result of analysing high index score apps, the attribute of ease of use smartphone apps considers one of the factors that encourages people to use wellness apps (Choi and Stvillia 2014). One of the factors that affect individual choices of the applications is ease of use (Stvilia et al. 2009). In the study of Stvilia et al. (2009), ease of use particularly has a significant impact on individual perception of application quality. Okumus and Bilghan (2013) point out that ease of use is one of the important enhancements that can promote the understanding of health smartphone apps. Okumus and Bilghan (2013) state that apps should be easy to use, even for novice users, and should include a friendly user interface to assist in that. Thus, if Ease of Use is considered as of the emerging factors to use the wellness app, it is additionally recommended to be included in the weight loss and diet apps and thus evaluation framework.

*Reminder* category was considered relevant and in scope of this research as it has accompanied to high index score apps user reviews. The literature also has supported the existence of this element in wellness apps. Mobile health offers a broad array of methods to improve the quality of life of adults. Popular health related functions including reminders and alerts could encourage individual to sustain positive attitudes (Center for Technology and Ageing 2011). The ability to provide reminders and alerts is another enhancement requirements in health smartphone apps (Okumus and Bilghan 2013). According Okumus and Bilghan (2013), Reminders could encourage the user to use the health app in early stages. Therefore, as reminders and alerts encourage positive attitudes, which could include managing weight, it should be one of the significant factors in weight loss and diet apps and hence evaluating framework. This initial finding supports the initial finding 1 of Chapter 5 as this research had previously agreed on the importance of the Reminder attribute in wellness apps. However, it has overlooked in this research, as assessing this attribute would exceed the available resources.

Literature has agreed on the importance of the existence of *Bar Code Scanning* attribute—in weight loss and diet apps. Mault (2003) states a number of methods of assisting individuals to achieve a weight control goal. According to Mault, bar code scanning can be used to scan foods to be consumed and access other information, such as data concerning exercise. A bar code scanner may be used to record information about consumption (Mault 2000). The nutritional data of food consumed can be recorded using the bar code scanner function. Information related to diet and weight loss can be transmitted to apps through the bar code scanning hence it is an effective method in managing weight (Mault 2003). Okumus and Bilghan (2013) point out that

*“Barcode reader helps users to scan the barcodes of items and keeps track of nutritional information” ( Okumus and Bilghan 2013, p.36).*

In addition, the authors state that

*“User scans the barcode for a generic item and selects the portion intake; the app keeps track of nutritional information of scanned items” (Okumus and Bilghan 2013, p.36).*

As the barcode reader can track nutritional information, it can increase nutrition information exposure. Previously, this research has discussed the importance of increasing nutritional information and knowledge in weight loss and diet apps (see chapter 5, section 5.3.1). Thus, the bar scanning attribute is a significant emergent attribute for diet and weight loss.

*Motivation* category has considered relevance and in scope of this research as it associated to high index score apps user reviews. The concept of the *Motivation* category has been included in the weight loss evaluation framework of Azar et al.(2013) (see Chapter 5, section 5.3, and 5.3.1). It was also mentioned in the Alagöz et al. (2010) design strategies of wellness applications in the strategy named “*Positive*” (see Chapter 5, section 5.3, and 5.3.2). According to Ahtinen (2008, b), wellness technologies and wellness applications should be designed to motivate users to continue to use wellness technology and so achieve goals. Ahtinen (2008, b) points out that there are several attributes that can increase motivation towards physical activity, including real-time feedback and virtual personnel trainer. The author claims these attributes would be motivating for the user to engage in physical activity. Thus, such motivating attributes should be found in the weight loss and diet apps.

The concept of *Usable for All* category has been explained previously in this chapter, section 7.2.3, which refers to the suitability of an app to a wide variety of individuals. For example, a wellness app can be offered in different languages, can include exercises that suit women and men or different age ranges. The category includes different products, diet plans and foods suitable for different people, such as individuals with diabetes, providing options for pregnant women or offer guidance to those following a vegetarian diet. By giving several options, the app would not restrict their users to particular trend of products. Thus, it would give a freedom of choice for apps users. Therefore, *Usable for All* is an emergent factor for attracting the user to use the weight loss and diet app.

*Synchronisation* category has considered relevance and in scope of this research. Synchronisation is a very important aspect in smartphone apps. Smartphone apps has the capacity to provide further functionality when synchronised with other technology. For example, sync the app with wearable medical devices. Wearable medical devices provide a huge advantage in the monitoring and early detection of symptoms (Saviotti

2012). According to Saviotti (2012), the sensors in these wearable medical devices enable monitoring vital signs and physiological parameters such as electrocardiogram (ECG), heart rate, body activity, blood pressure and weight, just to name a few. Early examples of independent wearable devices are FitBit, Jawbone and Samsung Gear Fit. Nowadays, there are emerging mobile applications that allow syncing with the most popular wearable devices and smartphones and aim to facilitate and enhance health care management (Sartain 2014). Thus, as this feature can facilitate and improve managing health feature is recommended as an emergent factor in weight loss and diet app evaluations.

Currently, there is a huge potential for the leader markets (I.e. iTunes and Google Play) to introduce these wearable health systems. Apple is marketing on a sensor laden smart watch. This wearable device will synchronize with an iPhone using Bluetooth and other wireless technologies. Likewise, Google is working on its own smart watch. Recently Samsung introduced an improved smart watch that supports basic health measurement functionality (Gurman 2014). Therefore, it can be concluded that there is a probability that the use of these wearable health devices that enhance and ease-managing health features will increase in the future. Hence, the ability of app to sync with such devices would further inform the evaluation of weight loss and diet apps.

Thus, the existence of the concept of the aforementioned categories in health apps particularly weight loss and diet apps is required.

- **Initial Finding Three**

As previously presented in this chapter, the thematic analysis of Google Play apps user reviews has revealed categories that were related to the evaluation frameworks elements and other categories that were not. Although all the evaluation framework elements were found in the categories that resulted from the thematic analysis of 402 Google Play user reviews, *Comprehensive* was the only evaluation framework element that was not observed in the reviews. This outcome is consistent with the initial finding four that has been discussed in chapter 6, which states that none of the Google Play apps has included features related to the *Comprehensive* element of the evaluation framework.

- **Initial Finding Four**

As Google Play apps had more user reviews than iTunes apps, a larger number of related categories were found when analysing their user reviews. Therefore, there were more Google Play apps where the ***Index Score*** values, gained when applying the evaluation framework on apps, matched the number of the found related categories than occurred with the iTunes apps. In other words, for Google Play apps, there were more ***Related Categories*** matched the obtained elements of evaluation framework than iTunes apps. The large difference in the number of iTunes apps user reviews and Google Play apps user reviews analysed was the main reason for this outcome.

### 7.7 CHAPTER REFLECTION

This Chapter has presented the outcomes of the deductive thematic analysis for the app users reviews. Deductive thematic analysis was suitable as it assisted in the interpretation of identifiable themes. It has demonstrated the number of apps user reviews that have been analysed using a deductive thematic analysis and presents the emerged categories that resulted from the analysis of the iTunes and Google Play apps user reviews. Analysing the categories revealed that some categories were directly related to the elements of evaluation framework and some categories were not. The chapter has shown the frequency of emerged categories that related to the evaluation framework. It has presented the existence of categories that related to elements of evaluation framework in iTunes and Google Play user reviews. It has demonstrated a comparison between the outcomes of thematic analysis and the outcomes of applying evaluation framework to the iTunes and Google Play apps. It concluded with a discussion of the main initial findings of thematic analysis phase.

The next chapter will present a synthesis of the research main findings.



# Chapter Eight

## Discussion of Findings

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## 8. DISCUSSION OF FINDINGS

### 8.1 INTRODUCTION

This chapter reintroduces the research question and the associated research objectives. It provides answers to the objectives of this research that lead to answering the research question. In addition, it presents the key outcome (KO) and key findings (KF) that were gained from all the stages of this research (see Chapters 4, 5, 6, and 7). This chapter is structured into the following sections:

- Section 8.2 reintroduces the research question and the associated objectives and demonstrates the answers to the research question and the associated objectives. The answer to the research question and the associated objectives has been produced from all stages of this research (see Chapter 4, 5, 6, and 7).
- Section 8.3 presents the key outcome and key findings of this research. The key finding of this research are as follow:
  - ✓ **KO:** This research has developed a justified weight loss and diet smartphone apps evaluation framework, which is suitable for evaluating weight loss and diet smartphone apps.
  - ✓ **KF 1:** The most downloaded iTunes and Google Play apps are not necessarily are the most usable and effective apps.
  - ✓ **KF 2:** The search algorithm for iTunes and Google Play is biased towards apps title keywords that do not accurately define the real function of the application.
  - ✓ **KF 3:** *Ease of Use, Reminder, Bar Code Scanning, Motivation, Usable for All, and Synchronisation*<sup>\*</sup> are important elements that should be included in weight loss and diet smartphone apps and thus in the weight loss and diet evaluation framework.

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<sup>\*</sup> For definitions refer to section 7.2.3 in Chapter 7.

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## 8.2 ANSWERING THE RESEARCH QUESTION AND OBJECTIVES

This section reintroduces the research question and the associated objectives to provide focus for the discussion provided in this chapter. As presented in Chapter 1, section 1.2, the aim of this study was to investigate the Australian smartphone stores (iTunes, and Google Play) to examine the efficacy of health wellness apps particularly in the arena of diet and weight loss as a review of the literature revealed that the rates of overweight and obese are increasing in Australia over the last two decades (ABS 2013; National Health and Medical Research Council 2014).

As previously mentioned in Chapter 1, section 1.2, smartphones' applications play an important role in monitoring and managing individuals' weight (Connelly 2006). Although smartphone applications markets (iTunes, and Google Play) list hundreds of thousands of health applications, it is not always clear whether those applications are supported in credible sources (Choi and Stvilia 2014). In addition, despite the prevailing use of smartphone apps to aid with weight management, the usability feature of these applications is not well characterised (Azar et al. 2013). Thus, this research aimed to add to this field.

The following research question and associated research objectives were designed to meet the aforementioned research aim.

### *Research Question*

**How can a usability framework inform download popularity of socially focused wellness smartphone applications?**

### *Research Objectives*

To answer the research question, it was necessary to fulfil the following objectives of this research:

- Identify the most popular weight loss and diet apps according to specific criteria that allow developing an understanding of Australian weight loss and diet apps.
- Build a framework for evaluating the identified apps and apply this evaluation framework to the applications.

- Compare the outcomes of the developed evaluation framework to specific metrics for justification.

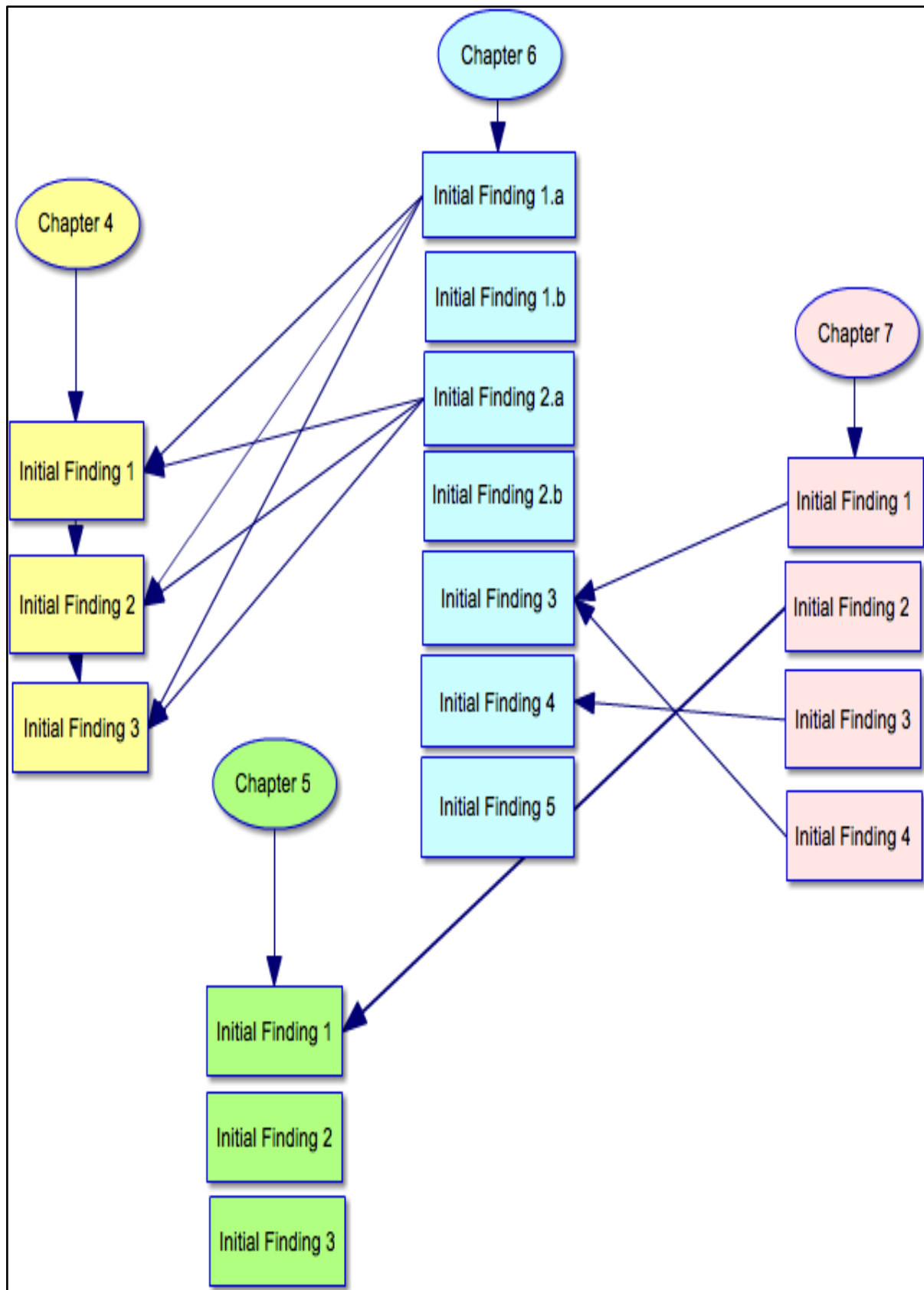
By identifying the most popular weight loss and diet apps, according to specific criteria, the study was able to focus on analysing these top popular apps. Narrowing the choice of the analysed apps was required to meet the first research objective and thus contribute to answering the research question.

Building a framework for evaluating the identified apps and applying this evaluation framework to the applications was essential in order to evaluate these apps, based on the developed weight loss and diet evaluation framework (see Chapter 5).

Comparing the outcomes of the developed evaluation framework to specific metrics for justification, by incorporating a thematic analysis phase of iTunes and Google Play apps user reviews (see Chapter 7), was needed to support the outcomes of the developed evaluation framework. In addition, it was important to add users' insights towards the framework that had been developed using current literature, and to add new user insights on any missed elements that could have been included in the weight loss and diet evaluation framework.

This research has resulted in 14 different initial findings that resulted from Chapter 4, 5, 6, and 7 of this research. Figure 8.1 demonstrates the relationship between these findings. In addition, this Chapter discusses the relationship between these initial findings. Previously, in each of the four Chapters, the inter-relationship between the initial findings of that chapter were presented.

Figure 8.1: The Relationship Between The 14 Main Initial Findings Of This Research



### **R. O1: Identify The Most Popular Weight Loss, And Diet Apps According To Specific Criteria.**

The identification process of most popular weight loss and diet iTunes and Google play apps has previously been detailed in Chapter 4.

#### **iTunes Top Popular Apps**

The total number of apps in the iTunes store as a result of the search terms “weight loss” and “diet” was 1000 apps. 500 apps resulted from the search term “weight loss” and 500 apps resulted from the search term “diet”. However, as mentioned previously in this research, the restriction of the available resources of this study has required limiting the number of apps included in the analysis. Thus, this study has only focused on the top 30 popular apps resulted from each term that followed specific inclusion criteria.

The apps were collected from the iTunes store on 24 June 2014 by using the search term “weight loss”. The total number of apps resulted from the search term “weight loss” were 500 apps. The most popular apps from the Australian iTunes App store were collected on 25 June 2014 from iTunes store. The top 30 popular apps that resulted from the search term “weight loss” were only considered to examine the specific inclusion criteria (App language is English, Free app, related to weight loss and diet apps, consumer oriented app and high rating app) (See Chapter 4). The apps that met the previous inclusion criteria were included in the analysis. Otherwise, the app has excluded (see Appendix 1).

On 24 June 2014, the apps were collected from the iTunes store by using the search term “diet”. The total number of apps resulted from the search term “diet” were 500 apps. The most popular apps for Australian iTunes App store were collected on 25 June 2014. The top 30 popular apps that resulted from the search term “diet” were only considered to study the aforementioned inclusion criteria (see Appendix 2). The apps that met the inclusion criteria has analysed and other have excluded.

Although there top 30 apps resulted from the search term “weight loss” (see Appendix 1), only 12 apps has met the inclusion criteria of this study and hence they have included in the analysis (see table 4.1 in Chapter 4). Two of the top 30 popular apps did not have any stars rating in the Australian iTunes Store and hence excluded.

The rest of the 16 apps have excluded, as they did not meet one or more of the inclusion criteria of this study. While grey rows in Table 4.1 in Chapter 4 demonstrated the apps that have been excluded from the study, white rows demonstrated the apps that are included in the study.

Likewise, the top 30 popular apps from the search term “diet” were identified. 19 apps have been included in the analysis as they met the inclusion criteria for this study. However, 11 apps were excluded, as they did not meet one or more of the inclusion criteria. The grey rows in Table 4.2 in Chapter 4 presented the apps that have been excluded from the study and the white rows presented the apps that are included in the study.

### **Repeated iTunes Apps that Resulted From the Search Terms “Weight Loss” And “Diet”**

**Repeated apps** are the apps that appeared in the apps’ results page even though different search terms have been used. In the iTunes store, repeated apps were present in the search for weight loss apps and appeared again in the search for diet apps. iTunes repeated apps resulted from the search terms “diet” and “weight loss” are presented in the table 4.3 in Chapter 4.

The total number of iTunes’ most popular apps that resulted from both search terms, and which met the inclusion criteria, was 31 apps. However, the number of apps was reduced from 31 to 25, as there were six repeated apps that met the inclusion criteria. This reduction is necessary to overcome the duplication of apps. The rest of the repeated apps did not meet the inclusion criteria. The six repeated apps were as follow:

1. My Diet Coach – Weight Loss for Women by InspiredApps,
2. Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution by EveryDay Health Inc.,
3. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss by MapMyFitness, Inc.,
4. Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... by Surf City Apps LLC,
5. Calorie Counter & Diet Tracker by MyFitnessPal by MyFitnessPal Inc.,

6. Happy Scale: Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log... by Front Pocket Software LLC.

### *Included iTunes Apps*

A total of 25 out of the possible 60 Australian iTunes' most popular apps that resulted from the search terms "weight loss" and "diet" are included in the analysis (see the white rows in the table in Appendix 8).

### *Excluded iTunes Apps*

A total of 29 out of the possible 60 Australian iTunes' most popular apps that resulted from the search terms "weight loss" and "diet" were excluded from the analysis. In addition, six apps were excluded because of duplication within the two search terms (see grey rows in the table in Appendix 8).

### *Google Play Top Popular Apps*

#### *Developed Scale for Measuring Google Play Apps Popularity*

A scale was developed to identify the most popular Google Play apps as Google Play, unlike iTunes, does not rank apps according to their popularity. Instead, Google Play provides the total number of downloads for each app in ranges such as 100-500, 500-1000 and so on. All of the possible number ranges of downloads in Google Play have been identified (Appendix 5).

To find the most popular apps in the Google Play store, all apps that resulted from the search terms "weight loss" and "diet" have been typed in rows in two separate Excel spread sheets in the same order as the apps appeared in the store. Next, the frequency of downloads that that Google Play store provide for each of the 250 weight loss apps and the 250 diet apps resulting from the search have been gathered and typed in another column. Utilising the Excel function =COUNTIF, allows counting the number of apps within a certain download range. The next step was to manually classify and arrange the apps based on their frequency of downloads. The 30 most popular apps are those that have been downloaded the most. Thus, to identify the 30 most popular apps in the Google Play store, a download range scale for measuring the download popularity of apps has been developed.



As a result of the developed scale and due to the selected apps having high downloads, the most popular apps categories were expanded in both search terms. To illustrate, the number of the most popular apps that resulted from the search term “weight loss” is 35 apps and not 30 apps (Appendix 6). Also, the diet most popular apps have been extended to 32 apps (Appendix 7). It was not possible to more accurately choose the 30 most popular apps, as there were a number of apps that had the same range of download. Choosing some of these apps and disregarding others with the same range of downloads, would have caused an inconsistency. Thus, all of the most popular apps located in the same range of downloads have been included in the analysis.

The Google Play “weight loss” apps that were included in this study came from the following download ranges: One app was located in the range of 10,000,000-50,000,000; a second app was located in the range of 5,000,000 - 10,000,000; four additional apps were in the 1,000,000-5,000,000 category; Seven apps were located within the range of 500,000-1,000,000; and 22 apps were located within 100,000-500,000 range. The total number of these apps was 35. None of the apps located in the range of 100,000-500,000 were excluded as all had the same range of downloads. For this reason, the number of the most popular apps from the Google Play store was expanded from 30 to 35 apps. For this reason, the top 30 popular “weight loss” apps groups from the Google Play store have been expanded. Also, the “diet” top popular apps have been extended to 32 apps for the same reason.

The total number of apps from the Google Play store, as a result of the search terms “weight loss” and “diet”, was 500. However, the restriction of the available resources of this study forced this research to limit the number of apps included in the analysis. Thus, this study only focused on the 30 most popular Google Play apps.

Apps were collected from the Google Play store between 26 and 30 June 2014 by using the search term “weight loss”. The total number of apps that resulted from the search term “weight loss” was 250 (Appendix 3). The download popularity of Google Play apps was identified by using the developed scale for measuring the download popularity. The total number of the most popular apps, as a result of the search term “weight loss”, was 35. The result was 35 not 30 apps, as mentioned previously, because Google Play does not arrange apps in accordance with their downloads popularity like iTunes. Instead they provide the number of downloads in ranges. Only the 35 most

popular apps were considered for inclusion. The grey rows in Table 4.4 in Chapter 4 present the apps that were excluded from this study and white ones show the apps that were included in this study, based on the aforementioned criteria.

Apps were collected from the Google Play store on 1 July 2014 by using the search term “diet”. The total number of apps that resulted from the search term “diet” was 250 (Appendix 4). The developed scale for measuring the download popularity was utilised to identify the most downloaded Google Play apps. The total number of most popular apps resulting from the search term “diet” was 32. The result of 32 not 30 apps, as planned, was because Google Play does not rank their apps based on downloads popularity,. Identifying the most popular apps depends on the developed scale of downloads popularity. Only the 32 most popular apps, out of the possible 250, were considered for inclusion. Grey rows in Table 4.5 in Chapter 4 present the apps that were excluded from the study and white rows present the apps that have been included in this study, based on the aforementioned criteria.

The total number of the most popular apps, as a result of the search terms “weight loss” and “diet”, were 67. However, of the 35 most popular apps resulting from the search term “weight loss”, only 19 apps met the inclusion criteria of this study. The remaining 16 apps did not meet one or more of the inclusion criteria for this study and therefore were excluded.

From the 32 most popular apps resulting from the search term “Diet”, only 10 apps met the inclusion criteria for this study. The remaining 22 apps did not meet one or more of the inclusion criteria for this study and therefore were excluded.

### **Repeated Google Play Apps That Resulted From the Search Terms “Weight Loss” And “Diet”**

***Repeated apps*** are apps that appeared in the apps’ results page even though different search terms had been used. In this case, repeated apps were the apps that appeared in the weight loss search and appeared again under the diet search. There were 6 apps repeated out of the 67 apps. Table 4.6 in Chapter 4 has demonstrated these repeated apps.

As result of this repetition, the number of apps was reduced from 29 to 26 as three of those apps met the inclusion criteria namely (1) Diet Assistant - Weight Loss by

Alportela Labs, (2) My Diet Coach - Weight Loss by InspiredApps (A.L) LTD, and (3) Diet Point · Weight Loss by DietPoint Ltd. The rest of the repeated apps did not meet the inclusion criteria of this study and thus were excluded early.

### *Included Apps*

The total number of the Australian Google Play most popular apps that resulted from the search terms “weight loss” and “diet” that were included in the analysis was 26 out of a possible 67 apps (see white rows in the table in appendix 10).

### *Excluded Apps*

The total number of Google Play most popular apps that resulted from the search terms “weight loss” and “diet” that were excluded from the analysis was 38 out of a possible 67 apps. Three other apps were excluded because of duplication (see grey rows in the table appendix 10).

Identifying iTunes and Google Play apps resulted in three additional initial findings (see Chapter 4, section 4.4). All of these initial findings have indicated that the iTunes and Google Play search algorithm was biased towards apps titles keywords. Figure 8.1 demonstrates the relationship between these three initial findings of Chapter one and initial finding 1 and 2 of Chapter 6 (see Chapter 6, section 6.5).

### R. O2: Build A Framework For Evaluating The Identified Apps And Apply This Evaluation Framework To The Applications.

The developed weight loss and diet apps evaluation framework was developed based on utilising a content analysis of the literature. Chapter 5 has previously detailed the outcomes of building evaluation framework based on utilising a content analysis of the literature.

#### *Method of Evaluating Apps*

As previously mentioned in the literature review, chapter 2 (section 2.4 and 2.4.2), the analysis of previous literature has identified two main methods for evaluating wellness smartphone apps. Firstly, the Harrison, Flood, and Duce (2013) style of evaluating apps, aims to evaluate apps according to PACMAD (People At the Centre of Mobile Application Development) model. The PACMAD model evaluates the following elements: effectiveness, efficiency, satisfaction, learnability, memorability, errors, and cognitive loads. In addition, it considers three main factors: user, task, and context (Harrison, Flood, and Duce 2013). Each of these elements has its own utility to be evaluated. The PACMAD model is a comprehensive model and can evaluate apps based on these several general elements. However, evaluating large numbers of apps using the PACMAD model requires intensive resources, including time and participants to contribute in the assessment process. Thus, the PACMAD model was not within the resources of this research.

To illustrate how this model requires extensive resources, consider effectiveness, one of the usability elements of PACMAD model. According to Harrison et al. (2013),

*“effectiveness is measured by evaluating whether or not participants can complete a set of specified tasks”* (Harrison et al. 2013, p.4).

As the research aim and objectives were to identify the most popular weight loss and diet apps according to specific criteria and to evaluate their efficacy, it would have been time consuming to evaluate the effectiveness of each app in the aforementioned way. This research has identified 51 Google Play and iTunes apps (see chapter 4), which was considered to be a large number of apps to be individually evaluated in Harrison et al. (2013) style of evaluating wellness apps.

Likewise, measuring memorability requires examining participants' use of apps after a period of inactivity with it. There is a real issue in recruiting participants who are willing to return a multiple of times to participate in an evaluation (Harrison et al. 2013). Thus, evaluating 51 apps would be time and resource consuming which would exceed the available resources for this research. Detailed discussion about the unsuitability of the PACMAD FOR this research has previously presented the Chapter 5, section 5.3.

By analysing the literature, another method of evaluating wellness apps was identified. There are several studies such as Breton et al. (2011), Azar et al. (2013), IMS (2013), and Abroms et al. (2013) that have evaluated wellness apps by firstly identifying predefined usability elements. For example, in Breton et al. (2011), Azar et al. (2013), the elements were related to weight loss and diet. Then, the apps were evaluated according to the presence or absence of these usability elements in the apps. However, in the study of Abroms et al. (2013), the elements were related to smoking cessation.

Each of the aforementioned studies has developed certain scoring system for evaluating apps. To illustrate, Breton et al. (2009) examined the contents of each app based on 13 pre-defined weight loss related elements (see section 2.4.3 in Chapter 2). If the elements were present in the app, the app then would take a certain score. Then the app scores of all 13 elements were calculated and the total score was obtained as an index score for the app. By evaluating several apps based on specified usability elements, each app should have its own index score value. Then, the apps could be ranked according to their index scores.

The presence and absence of the elements could be represented in different ways. It could be represented as numbers, such as in the studies of IMS Institute for healthcare informatics (2013) and Abroms et al. (2013). For instance, in the Abroms et al. study, each item was coded as 0 indicating "not present at all", 1 indicating "partially present", or 2 indicating that the element is "fully present". It could also be coded as yes=1 or no=2 as in the Azar et al. (2013) study or by denoting "X" which means x=1 like in Breton et al. (2009) study.

The second method of evaluating apps was more appropriate for this study as the elements of PACMAD model are general in its nature and therefore might be less

efficient if used to determine the efficacy of weight loss and diet apps. In addition, as previously discussed, applying PACMAD model for large number of apps would exceed the available resources of this research. Thus, the Breton et al. (2009) method of evaluating apps was followed in this research.

### ***Elements of Evaluating Apps***

As discussed in Chapter 5, the proposed evaluation framework included elements related to the usability and to the design of apps. The usability elements of weight loss and diet apps evaluation framework for this research were based on the common elements gained from Breton et al. (2009), Azar et al. (2013), IMS (2013), and behavioural weight loss strategies (Pagoto et al. 2013). However, one of the usability elements (namely *Regular Physical Activity*) has been included as it was a common element between these studies. However, reviewing the literature has proved the importance of it in the context of weight loss and diet. The design elements were based on Alagöz et al. (2010) wellness apps design strategies.

### ***Usability Elements***

By analysing the literature, several usability elements were identified which can be used for evaluating weight loss and diet apps. However, four elements that related to the functionality of weight loss and diet apps were included for this study, as they were the common elements within the three wellness apps evaluation frameworks (Breton et al. 2009; Azar et al. 2013; IMS Institute for healthcare informatics 2013) or they were included in the weight loss behavioural strategies (Pagoto et al. 2013). One of the usability elements was not common in the previous studies namely *Regular Physical Activity*. However, the literature agrees on its significance on weight loss and diet apps. As the selected four elements are the shared elements between the aforementioned studies, these elements were considered to have a greater need of inclusion, as other elements were only included in the previous studies once or twice. Thus, they have been included in the evaluation framework. The following are the included elements that related to app functionality:

#### **1. *Ability Of App For Self-Monitoring (Monitoring User Data (Weight)):***

This element is concern with checking whether the app provided a means of tracking a user's weight across a period of time and allowed the user to see the start weight and the end weight. In the evaluation of apps, the app was scored, based on

whether it provided a means of tracking weight over time or not. This element was included as it was found in all of the following three studies: Breton et al. (2009) included the weight-tracking feature in their weight loss and diet evaluation framework. The concept of weight tracking was included in Azar et al. (2013) diet/nutrition and anthropometric evaluation framework. In addition, the evaluation framework for IMS Institute for healthcare informatics 2013 has included the self-monitoring concept in their wellness evaluation framework. (IMS Institute for healthcare informatics 2013).

Hence, as the concept of weight tracking was found in three different wellness apps evaluation studies, it is considered to be an important element in evaluating weight loss and diet apps. As a result, it was included in the suggested evaluation framework for this research. To support the finding of content analysis, the literature was also reviewed to check the importance of this element in the context of weight loss. Chapter 5, section 5.3.1 has previously interpreted and discussed the importance of this element in detail.

### **2. *Ability Of App To Social Support:***

This element covers the features of online social support and not the traditional social support. The app should give users access to a social network so that they can benefit from others who use the same app and share the same interests. In addition, the app should provide users with a discussion board, or forum. Thus, the app was scored on whether it allowed users access to social support services such as message boards, chat rooms, email an expert, or a networking component like Twitter.

This element was included as it was a common element within the following four studies. Breton et al. (2009) included the element of social support in their weight loss and diet evaluation framework. Likewise, Azar et al. nutrition and diet evaluation framework included this feature. Also, the evaluation framework for IMS Institute for healthcare informatics (2013) included the social support element. Besides, Pagoto et al. (2013) study included the element of online social support as one of the seven technology-enhanced features identified as being directly relevant to behavioural weight loss strategies.

The concept of social support was found in four different studies. Therefore, it was regarded as a significant element in evaluating weight loss and diet apps. As a result, it was included in the suggested evaluation framework for this research. To support the

finding of content analysis, the literature was also reviewed to assess the importance of this element in the context of weight loss. Chapter 5, section 5.3.1 has previously interpreted and discussed the importance of this element in detail.

### **3.     *Availability Of Knowledge Resource:***

This element evaluates whether an app increases the user's nutritional knowledge. The app was scored, based on whether it provided a knowledge resource that could assist users of the app to increase their knowledge/information related to nutrition, and their awareness of weight control or reduction. This element was included as it was found in the following three studies: Breton et al. (2009) included this element in their evaluation framework; Azar et al. (2013) evaluation framework included the concept of increasing knowledge explicitly; and that knowledge comprises information, the concept of knowledge, was tacitly mentioned in the IMS evaluation framework.

The concept of increasing knowledge was found in three different wellness app evaluation studies. Thus, it was considered to be an important element in evaluating weight loss and diet apps. As a result, it was included in the suggested evaluation framework for this research. To support the finding of content analysis, the literature was also reviewed to evaluate the importance of this element in the context of weight loss. Chapter 5, section 5.3.1 has previously interpreted and discussed the importance of this element in detail.

### **4.     *Weight Loss Goal:***

This element covers the concept of weight loss goal. The app was scored on whether it recommended certain weight loss goals for their users or allowed users to enter targeted weight. This element was taken into account as it was found in the following three studies: in the Breton et al. study; Azar et al.'s study; and Pagoto et al. (2014) behavioural weight loss strategies.

As the concept of weight loss goal was taken into account in three different weight loss studies, it was considered to be one of the main attributes in evaluating weight loss and diet apps. As a result, it was included in the suggested evaluation framework for this research. To support the finding of content analysis, the literature was reviewed to check the importance of this element in the context of weight loss. Chapter 5, section 5.3.1 has previously interpreted and discussed the importance of this element in detail.



### **5. Regular Physical Activity:**

The app was also scored on whether it recommended specific amounts of physical activity. Although this element was only mentioned in two of the included studies (Breton et al. 2009; Pagoto et al. 2013), it was still included in the framework as many other references agreed on the importance of regular physical activity for weight loss. Chapter 5, section 5.3.1 has previously interpreted and discussed the importance of this element in detail.

### *Overlooked Elements*

There were several elements that have been overlooked (e.g. time management and stress reduction). These elements were only included in one or two of the studies (see Chapter 5, section 5.3).

All the elements that comprised the evaluation framework for this study were included in at least three of the included studies (i.e. Pagoto et al. 2013; IMS Institute for Healthcare Informatics 2013; Azar et al. 2013; Breton et al. 2009). The only exception was the element of the physical activity because of its importance in the context of weight loss and diet as previously mentioned. Conversely, the element related to the reminder function was mentioned in three studies namely (Azar et al. 2013; Pagoto et al. 2013; and IMS Institute for healthcare informatics 2013) but was not included in the evaluation framework for this study as this function usually requires a period of time to examine. Thus, the time constrain of this study required that this element not be included in the developed evaluation framework. This finding of Chapter 5 is supported by initial finding two of Chapter 7 (see Chapter 7, section 7.6), which shows the importance of the Reminder element as it emerged as category when analysing apps user reviews (demonstration of this relationship in figure 8.1).

### *Design Elements*

Alagöz et al. (2010) point out the importance of considering the hedonic design aspects besides the functional side when developing health wellness apps. As the design of a wellness application is important and as none of the aforementioned previous apps evaluation studies has focused on app design in evaluating wellness apps, this research has considered evaluating wellness apps design strategies. The studies related to wellness apps design strategies in the literature were rare and thus this field may need

more researches. The emphasis was only on Alagöz et al. (2010) study to identify the required design elements for wellness apps.

Alagöz et al. (2010) suggested a set of design strategies for wellness applications and gave examples of their application in health apps (see Alagöz et al. 2010 page.44). Alagöz et al. (2010) claim that these design strategies aim to support behavioural change and social psychological theories. Also, these design strategies take into account hedonic aspects of wellness applications. Chapter 5, section 5.3.2 has detailed these strategies

This research has included six of these design strategies in the proposed evaluation framework, which are: *Abstract & Reflective*; *Public*; *Aesthetic*; *Controllable*; *Trending/Historical*; and *Comprehensive*. The resources available to this research limit it to these six out of the possible eight strategies (see Chapter 5, section 5.3.2).

Two of the strategies were excluded, namely *Unobtrusive* and *Positive*. Evaluating the *Positive* strategy could be done as this would involve significant difficulty in examining it. To study whether the apps supported users with positive reinforcement and avoided negative reinforcement would require extensive evaluation time. As this feature would exceed the time resource of this research, this strategy has been excluded. Likewise, the *Unobtrusive* strategy was excluded because considering it would exceed the available resources of this research. To consider this strategy would require having two different iOS mobile smartphones and two different Android devices, which exceeds the available resources of this research (see Chapter 5, section 5.3.2).

The considered design strategies that are included into the evaluation framework for this research are as follow:

### **1. *Abstract and Reflective*:**

This strategy is concerned with scoring an app on the basis of whether it provides a graph, chart or other virtual means to easily reflect the data of the user or allows the user to clearly see their progress in a more abstract and reflective way. According to Ahtinen et al. (2008), the wellness application should be able to visualise and inform the users of their progress. In the study of Ahtinen et al. (2009) which examined user experience in three wellness apps, they discovered that the main motivating factor in one of the examined apps, specifically Wellness Diary, was the graphs that provided

long-term information about users' progress. Thus, this element is important to be included in this study. More discussion about this element is found in Chapter 5, section 5.3.2.

### **2. *Public:***

This strategy aims to evaluate an app on whether it provides login feature or something similar such as allowing the user to create a username and password to avoid unwanted disclosure of their personal data (see Chapter 5, section 5.3.2). Ahtinen et al. (2009) states that there are four factors related to the usability of health apps, which assist in the acceptance, and distribution of such technology in wellness promotion. These four factors are: user-friendliness; usability; user competence; and confidence. Confidence is related to being confident with the system's performance in protecting users' data and data security (Ahtinen et al. 2009). Thus, as confidence is related to protecting users' data, it is considered one attribute of promoting wellness technology and its usability; the "public" feature covers the concept of confidence and therefore it is included in the framework.

### **3. *Aesthetic:***

An app was also scored on whether it enable the user to customise or adapt some features of the app according to their personal preferences (see Chapter 5, section 5.3.2). Ahtinen et al. (2009) claim that the user friendliness factor, which includes aesthetic presence and user interfaces, is one of the main factors that promote the use and acceptance of wellness apps. Therefore, considering the *Aesthetic* element in the evaluation framework was required as it is considered to be one of the significant factors that promote use and acceptance of wellness apps.

### **4. *Controllable:***

Controllable is a strategy concerned with scoring an app on whether it allows the user to manage data and control access to it (see Chapter 5, section 5.3.2). Ahtinen et al. (2008) point out that manual entering of data appears to increase the user control over what parameters to enter. Also, it raises the user's awareness of the physical activity level, thus increasing the level physical activity level. Manual entering can remove the issues of error-prone that could happen when the app depends only on

sensory data. As the manual data entry allows to gives users a level of controllability, it was recommended to be included it in the evaluation framework.

### **5. Trending / Historical:**

The trending and historical strategy scored an app on whether it enables users to access historical data to show changes and trends (see Chapter 5, section 5.3.2). Ahtinen et al. (2009) state, in their study of comparing three different wellness applications, that the Wellness Diary application was considered the most motivating mobile app in the trial as it provided information on the long-term progress of different aspects of wellness, e.g. steps and weight. Thus, as including the history data in wellness application is considered a motivating factor that allows long-term use, it has been included in the evaluation framework.

### **6. Comprehensive:**

The comprehensive strategy scored app on whether it allows users to manage data manually and whether it provides the option of collecting user sensory data (see Chapter 5, section 5.3.2). The perceived value of the wellness app has been relatively low in the short-term use when it depends only on manual data entries as this requires some effort (Ahtinen et al. 2009). Ahtinen et al. (2008) point out that automatic logging in removes the perceived burden of logging from users and allows continuous logging, as users do not forget to enter data. However, sensory entering of data could increase the entered data errors and reduce the user's level of awareness of entered data (Ahtinen et al. 2008). Therefore, combining automatic and manual logging is required (Ahtinen et al. 2008). Hence, this concept is covered under the element of comprehensive as it considers apps that allow users to manually enter data and collects sensory data more accurate than apps that just provide one of these features.

### **Index Score**

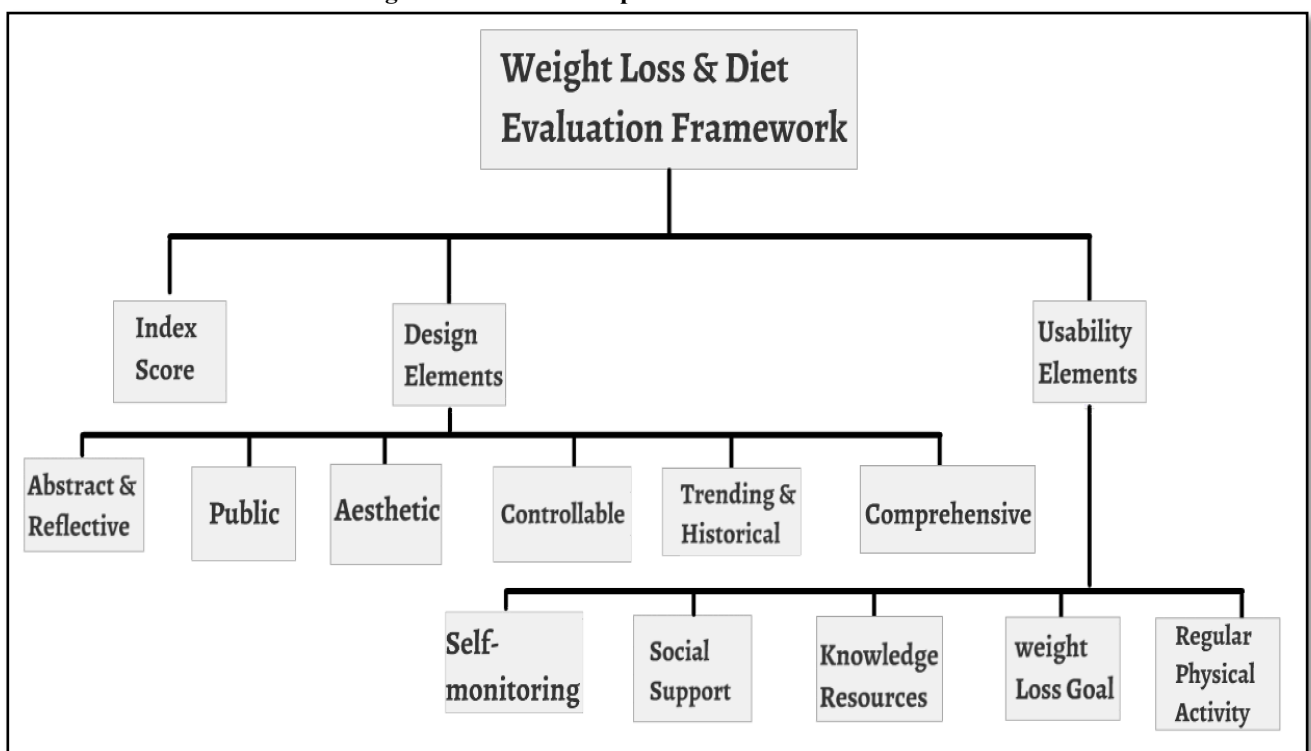
The last element of the evaluation framework was an element named the index score, which was based on the total scores from each of the usability and design elements. The index score was included in the evaluation framework as the apps evaluation method of this research was based on the evaluation method of Breton et al. (2009). The **Index Score** is a scored based on the aforementioned 11 functionality and design elements of the developed evaluation framework. The sum of the 11 scores

determines the index score. Index score values range from 0 to 11 with 11 being the maximum possible score. Therefore, to rank the apps according to the evaluation framework, it required collecting the total number of 11 elements that has been gained by an app in the index score.

The evaluation framework for this research was developed through content analysis of several studies (see Chapter 5). It is able to evaluate all weight loss and diet smartphone apps. Figure 8.2 summarises the elements of the developed evaluation framework.

The developed weight loss and diet evaluation framework has followed a robust evaluating method that is based on several wellness apps evaluation studies such as Breton et al. (2009), Azar et al. (2013), IMS (2013), and Abroms et al. (2013). It also included diverse evaluation elements to ensure more holistic evaluation of weight loss and diet apps. To illustrate, the developed evaluation framework has included elements related to the functionality of apps that are supported in the literature. In addition, it included elements related to the design of wellness application. The design side was disregarded by several wellness apps evaluation studies. Thus, the developed evaluation framework provides a more holistic evaluation of wellness apps, specifically, weight loss and diet apps.

**Figure 8.2: The Developed Evaluation Framework**



Applying the developed evaluation framework to the identified iTunes and Google Play apps identified in stage one of this research has resulted in several outcomes and five main initial findings (see Chapter 6, and section 6.5).

Initial Findings One and Two of Chapter six states that the outcomes of applying the developed evaluation framework has shown that none of the iTunes and Google Play apps have achieved the proposed highest index score value (i.e.11). There were two interpretations for these initial findings.

The first interpretation was that iTunes and Google Play search engines mainly consider the keywords entered by the users to retrieve the apps. Consequently, retrieving apps only by considering the keywords included in the apps may result in downloading some apps that are not truly related to weight loss and diet. Hence, when the developed evaluation framework evaluated these apps, they achieved low index score values. More discussion of these two initial findings is found in Chapter 6 section 6.5. Findings one and two of Chapter 6 support the three initial findings of Chapter one.

Initial Finding Three of Chapter 6 states that the existence of all elements of the evaluation framework in the iTunes and Google Play apps, additionally indicated to the relevance of the elements of evaluation framework. To illustrate, all the identified eleven elements were present in at least one or more of the iTunes and Google Play apps. This indicates that none of the identified elements were irrelevant or inappropriate in evaluating weight loss and diet apps. The outcomes of the thematic analysis of apps user reviews have resulted in 11 ***Related Categories*** that are directly related to the elements of evaluation framework. This supports that the elements of evaluation framework are relevant. Also it supported by Initial Finding Four of Chapter seven which indicated to that the outcomes of comparing the emerged ***Related Categories*** for each app and the outcome of the evaluation framework for each app is relatively matched in iTunes apps, with a closer match in the Google Play apps. As the number of user reviews are more in Google Play apps, the existence of ***Related Categories*** were more than in the iTunes user reviews. However, by assuming that if iTunes had the same amount of user reviews, the existence of the ***Related Categories*** would be more in iTunes user reviews. Thus, this indicates to the existence of the framework element in the apps, which supports finding three of applying the evaluation framework to the apps (Chapter 6, section 6.5). Figure 8.1 demonstrates these two relationship between the

initial finding three of Chapter six and the initial finding one and 4 of the thematic analysis (see Chapter 7, section 7.6).

The Fourth Initial Finding from applying the evaluation framework on iTunes and Google Play apps (see chapter 6, 6.5) had shown that in the iTunes apps all usability elements occurred in at least one app. However, in the Google Play apps, all usability elements except the element ‘Comprehensive’ were present in at least one app. ‘Comprehensive’ was the last element of the developed evaluation framework. It has been previously defined and discussed in Chapter 5 section 5.3.2. The importance of each of the evaluation elements in the weight loss and diet context, including the comprehensive element, have been discussed in initial finding three of Chapter 6 (see section 6.5). ‘*Comprehensive*’ is a significant attribute and it should be included in weight loss and diet apps. However, despite the importance of the comprehensive attribute in weight loss and diet apps, it was not present in any of the Google Play apps. This outcome was supported when the thematic analysis of Google Play user reviews found that there were no themes related to this element. Therefore, there was no category that related to the *Comprehensive* element (see Chapter 7, 7.6). This finding, from applying the evaluation framework to Google Play apps, matched initial finding three that resulted from conducting the deductive thematic analysis of Google Play apps user reviews (see Chapter 7, section 7.6). Figure 8.1 presents the relationship between initial finding four of Chapter six and initial finding three of the thematic analysis of Google Play user reviews.

Initial Finding Five from applying the evaluation frameworks to the identified apps, has resulted in more apps with an index score below average than above average. This supports the outcome that none of the apps has achieved a high index score value (see chapter 6, section 6.5, Initial finding 1, 2, and 5).

### R. O3: Compare The Outcomes Of The Developed Evaluation Framework To Specific Metrics For Justification.

The user reviews of the apps were examined by deductive thematic analysis to act as a justification metric for the outcome of the evaluation framework. This process generated a number of categories that were directly reflected in the framework, and other categories that had no relation to the framework elements. The ***Related Categories***, developed from the thematic analysis, enriched the research by introducing a user point of view towards the framework that had been initially generated through the available literature. However, the ***Unrelated Categories***, developed from the thematic analysis, added additional insight and meaning to the apps ranking in the framework.

The thematic analysis phase of iTunes and Google Play apps user reviews (see Chapter 7, section 7.5), assessed whether the number of gained ***Related Categories*** for each app from the apps users reviews, matched the elements of the evaluation framework elements. In other words, it compared the ***Index Score*** values gained by each app when applying the developed evaluation framework with the resulted ***Related Categories*** observed in the users' reviews. As the content analysis used a quantitative element (i.e. Index Score) as a part of the rationale for inclusion of the ultimate framework elements, the related categories were accordingly viewed in the same manner. Conversely, because of the way the unrelated categories were formed, the interpretative nature of the research did not compare their existence with the elements of the evaluation framework (i.e. Index score values). Regardless of the potential relation to the framework, the mere existence of any unrelated category was deemed to be relevant. Accordingly, the unrelated categories were not ranked or order through any type of quantitative measure. This distinction between the analysis of the related and unrelated categories is in line with the philosophical nature of this research, which is subjective ontology and an interpretive epistemology (see chapter 3, 3.3).

#### 1. Analogous Outcomes

The comparison of emerged ***Related Categories*** from the thematic analysis of apps users reviews with the ***Index Score*** values has worked as a justification for the outcomes of the evaluation framework (see Chapter 6, table 6.2 and 6.3). The comparison has led to two main conclusions:



1. The number of *Related Categories*, recognised from analysing iTunes apps user reviews, relatively match the *Index Score* values obtained by employing the evaluation framework (see Chapter 7, section 7.5).
2. The number of *Related Categories* that were recognised from analysing the Google Play user reviews more closely matches the *Index Score* values.

Initial finding four of Chapter 7 states that, as Google Play apps had more user reviews than iTunes apps, a larger number of *Related Categories* were found when analysing the apps user reviews. Therefore, there were more apps in the Google Play where their *Index Score* values have matched the number of found *Related Categories* more closely than in the iTunes apps. In other word, the existence of the Related Categories in each Google Play app user review more closely matches the obtained elements of the evaluation framework for each app. Nevertheless, if it assumed that iTunes had a greater number of apps user reviews, the emerged Related Categories of the iTunes user reviews may have been more. Thus, initial finding four indicates the robustness of the developed evaluation framework, which supports initial finding one in Chapter 7. Initial finding one in Chapter 7 points out that the presence of the 11 Related Categories was an indication of the existence of all elements of the evaluation framework in the apps. This was an additional assurance of the robustness of the evaluation framework elements. To illustrate, all the found eleven thematic categories were related to the identified evaluation elements of the developed framework. This indicates that none of the identified evaluation framework elements were irrelevant or inappropriate in evaluating weight loss and diet apps. These findings support the developed evaluation framework and it ensures the robustness of the outcomes of the evaluation framework.

As the aforementioned discussion led to demonstrating a support for the developed evaluation framework and it ensures the relevance of the outcomes of the evaluation framework, reintroducing the main outcomes of applying the developed evaluation framework on the most popular iTunes and Google Play apps (Chapter 6) is required to answer the research question.

The first two main initial findings showed that none of the iTunes and Google Play apps achieved the proposed highest index score of 11 (see initial finding one and two in chapter 6, section 6.5). Even though the identified apps were the most popular iTunes

and Google Play apps, based on the developed evaluation framework, none were able to achieve the maximum index score of eleven. There were two ways to interpret this initial finding. The first focused on how iTunes and Google Play search engines consider the keywords entered by the users to retrieve the apps. Hence, when these apps were evaluated by the developed evaluation framework, they achieved low index scores (see Chapter 6 section 6.5). Thus, **this indicates to that the search algorithm of iTunes and Google Play was biased towards apps titles keywords..** This interpretation is consistent with the initial findings 1, 2, and 3 of Chapter 4 (see Chapter 4, section 4.4). The second interpretation was that being one of the most popular iTunes and Google Play apps does not necessarily indicate the usability or efficacy of the app (see Chapter 6 section 6.5). Thus, **on the basis of the developed evaluation framework, the achieved results for the most popular iTunes and Google Play apps indicates that the most downloaded apps are not necessarily the most usable and effective apps.** The second interpretation is also supported by the initial finding 5 of the application of the evaluation framework on the iTunes and Google Play apps (see Chapter 6, section 6.5).

### 2. Antonymous Outcomes

Thematic analysis and applying the evaluation framework to iTunes and Google Play most popular apps has led to the following distinctive outcomes:

As previously presented in the Chapter 7, analysing the iTunes and Google Play apps reviews has resulted in 12 ***Unrelated Categories*** that were not related to the elements of the evaluation framework: *Synchronisation, Feelings, Bar code Scanning, Usable for All, Reminder, Annoying Ads, Motivation, Improvement Suggestions, App Cons, App Pros, Ease of Use, and Recommended*. ***Unrelated Categories*** to the elements of the evaluation framework mean that the themes of these categories that constructed the categories were not related in wording, or meaning to the elements of the evaluation framework (i.e. *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, and Comprehensive*). The ***Unrelated Categories*** developed from the thematic analysis provided additional insight and meaning to the apps' ranking in the framework. Some of these ***Unrelated Categories*** emerged as result

of analysing iTunes and Google Play user reviews and some resulted from only one of them (details in Chapter 7, section 7.3).

The *Unrelated Categories* were formed through the interpretative nature of the research, which did not discount themes that had emerged from the user reviews, regardless of their potential relation to the framework. The mere existence of any unrelated category was deemed to be relevant. The *App Cons*, *App Pros*, *Improvement Suggestions*, *Recommended*, *Annoying Adds*, *Feelings* (definitions in section 7.2.3) *Unrelated Categories* were out of the scope of this research because the following reasons:

*App Cons*, and *Improvement Suggestions* were considered out of scope of this research as the content of these categories could help the apps developer only and investigating it was beyond the aim of this research. To illustrate, *App Cons*, and *Improvement Suggestions* categories could result in improving the apps performance if took into account when developing and designing weight loss and diet apps. See Chapter 7, section 7.6 for more explanation on these two categories. Considering these two categories would not inform the evaluation framework of weight loss and diet apps.

*App Pros*, and *Recommended* categories could be utilised by a user who wants to know the most advised apps for them to use because the *Recommended* category demonstrated the recommendation of using apps. As well, additional investigation of the *App Pros* category could show the advantages of each app (see Chapter 7, section 7.6). Thus, it could be more meaningful for users. However, a detailed investigation of these categories was beyond the scope of this research and it would not inform the evaluation framework of weight loss and diet apps.

*Annoying Ads* category informs the developers of the real issue of the extensive pop up ads in free apps that may result in the alienation of user from using wellness apps. According to Pocatilu (2011), free smartphone apps need Internet connection for producing advertisements. Distracting ads are arriving in Android apps (Cassavoy 2012). Popular free smartphone apps include many advertisements (ScienceDaily 2012). Thus, it would benefit developers if this were taken into account when designing wellness apps. See Chapter 7, section 7.6 for more explanation of this category. However, including this element into weight loss and diet framework is not required.

*Feelings* was also out of the scope of this research. More description of this category is found in Chapter 7 section 7.2.3 and 7.6. Although this category resulted from analysing Google Play user reviews, *Feelings* was out of the scope as it only resulted from analysing Google Play apps user reviews which did not achieve high index score values. Instead, it were associated with the apps user reviews with low index score values. It was found in the following apps: “My Diet Coach - Weight Loss” and “Weight Track Assistant”. *Feelings* might be an attribute that could add further dimension in using app. However, based on the developed evaluation framework based on several literature sources, it was considered a non-major attribute that was not necessary as an element for the weight loss and diet evaluation framework.

The *Ease of Use*, *Reminder*, *Bar Code Scanning*, *Motivation*, *Usable for All*, and *Synchronisation* **Unrelated Categories** (definitions in Chapter 7, section 7.2.3) were in scope of this research as they were found in the user reviews of apps that had high index score values. The existence of theses categories in the high index score user reviews reflected the importance of these elements in health apps particularly weigh loss and diet apps (see Chapter 7, section 7.6).

The *Ease of Use* category was considered one of the most important found unrelated categories (see section 7.2.3). In addition, the Ease of Use category was in the user reviews for almost all the apps that have high index score values (see Chapter 7, section 7.6). According to Choi and Stvilli (2014), the attribute of easy to use in smartphone apps encourages people to use wellness apps. One of the factors that affect individual choices of the applications is ease of use (Stvilia et al. 2009). Likewise, in the study of Stvilia et al. (2009), ease of use has a significant impact on individual perception of application quality. As it considered one of the encouraging factors to use the wellness app, it recommended to be included in the evaluation framework for weight loss and diet apps. Thus, ease of use of health apps considered of the important aspects that missed included in the developed evaluation framework.

Although the outcomes of the developed evaluation framework, as well as the literature, revealed the importance of the ease of use attribute in wellness applications, the concept of the *Ease of Use* category was not included in any of the analysed studies (see Chapter 5, section 5.3) (Breton et al. 2009; Azar et al. 2013; IMS Institute for healthcare informatics 2013; Behavioural Weight Loss Strategies; Pagoto et al. 2013).

The difficulty of measuring the ease of use might be main reason for the absence of this attribute in the previous studies. According to Okumus and Bilghan (2013), the measurement of ease of use was the learnability of the app.

According to Harrison et al. (2013), Learnability means the app should be easy to learn so that the user can rapidly operate the app.

*“Learnability is the ease with which a user can gain proficiency with an application” (p.4).*

It typically reflects the time need from a person to be able to use the application effectively.

In order to measure Learnability, *“researchers may look at the performance of participants during a series of tasks, and measure how long it takes these participants to reach a pre-specified level of proficiency” (p.4).*

According to Harrison et al. (2013), the learnability is one of the attributes that is not easy to evaluate; this might the reason for it predominatingly being overlooked in the literature of smartphone apps evaluations.

Likewise, the appearance of *Reminder, Bar Code Scanning, Motivation, Usable for All, and Synchronisation* categories in the apps user reviews has reflected the importance of these elements in health apps particularly weigh loss and diet apps. In addition, the existence of these categories in the user reviews for apps with high index scores reinforced their significance. However, these categories were not included in the developed evaluation framework.

Remarkably, the *Reminder* element was previously agreed to be significant in weight loss and diet smartphone apps in this research (see Chapter 5, section 5.3). However, it was excluded from the evaluation framework as the time required for to be assessed would exceed the time constraint of this study. Mobile health offers a broad array of methods to improve the quality of life of adults. Popular health related functions including reminders and alerts both of which could encourage individuals to sustain positive attitudes (Center for Technology and Ageing 2011). Therefore, as reminders and alerts encouraging positive attitudes, which could include managing weight, it should be one of significant attributes in weight loss and diet apps. Thus, the

inclusion of the *Reminder* attribute in evaluation of health apps, particularly weight loss and diet apps, would further inform the evaluation.

*Bar Code Scanning* has been mentioned in the weight loss strategies in the study of Pagoto et al. 2013 (see Chapter 5, section 5.3). Mault (2003) identified some methods of assisting individuals to achieve a weight control goal. According to him, the bar code scanning can be used to scan foods to be consumed and provide other information like data concerning exercise. Bar code scanners may be used to record information about consumption (Mault et al. 2000). The nutritional data of food consumed can be recorded using bar code scanner function. Information related to diet and weight loss can be transmitted to apps through the bar code scanning hence it is an effective method in managing weight (Mault 2003). Thus, the bar scanning attribute is a significant attribute in diet and weight loss apps. Therefore, the inclusion of the *Bar Code Scanning* attribute in the evaluation framework for weight loss and diet apps is essential.

The concept of the *Motivation* category was included in the weight loss evaluation framework of Azar et al.(2013) (see Chapter 5, section 5.3, and 5.3.1). It also was mentioned in the Alagöz et al. (2010) design strategies of wellness applications in the strategy named “*Positive*” (see Chapter 5, section 5.3, and 5.3.2). According to Ahtinen (2008, b), wellness technologies and wellness applications should be designed to motivate users to continue using wellness technology and so achieve their goals. Ahtinen (2008, b) points out that there are several attributes that can increase motivation towards physical activity, such as real-time feedback and virtual personnel trainer. He claims these attributes would strongly motivate users for physical activity. Thus, such motivating attributes should be found in the weight loss and diet apps. Ahtinen (2008, b) highlights the importance of considering the design of user interface of smartphone wellness apps to support and motivate users in the initial and long-term use. Thus, considering the attributes of user centred design of wellness applications that could improve motivations of users is important to inform evaluation of weight loss and diet apps. Hence, it is one of the important attributes that should be included in weight loss and diet apps.

Usable for All, and Synchronisation elements were not previously mentioned in the analysed studies of evaluating wellness apps (see Chapter 5, section 5.3). However, the

inclusion of the perception of these categories in the evaluation framework for weight loss and diet apps is recommended for the following reasons:

The concept of *Usable for All* category was previously explained in Chapter 7, section 7.2.3. *Usable for All* refers to the suitability of an app for a wide variety of individuals. For example, wellness apps can be used in different languages; can include exercises, suit women or men or a wide range of ages. The app may includes different products, diet plans and foods that are suitable for different people such as individuals with diabetes, for pregnant women, or vegetarian people...etc. By giving several options, the app would not restrict their users to particular things. Thus, it would give freedom of choice for app users. Therefore, this can be one of factors for attracting the user to the weight loss and diet app.

Synchronisation is a very important aspect in smartphone apps nowadays. Smartphone apps produce a further function if synchronised with other technology, for example, with wearable medical devices. Wearable medical devices provide a huge advantage in the monitoring and early detection of symptoms (Saviotti 2012). According to Saviotti (2012), the sensors in these wearable medical devices enable monitoring of vital signs and physiological parameters such as electrocardiogram (ECG), heart rate, body activity, blood pressure and weight, to name a few. Early examples of independent wearable devices are FitBit, Jawbone and Samsung Gear Fit. Nowadays, mobile applications are emerging that allow syncing with the most popular wearable devices and smartphones and can facilitate and enhance health care management (Sartain 2014). Thus, as this feature can facilitate and improve managing health care, it should play a part in weight loss and diet apps. Currently, there is a huge potential for the market leader (i.e. iTunes and Google Play) to introduce these wearable health systems. Apple is making a sensor laden smart watch, and that wearable device will synchronise with an iPhone over Bluetooth and other wireless technologies. Likewise, Google is working on its own smart watch. Recently Samsung introduced an improved smart watch that supports basic health measurement functionality (Gurman 2014). Therefore, it can be concluded that there is a probability that the use of these wearable health devices, that enhance and ease-managing health features, will increase in the future. Hence, the ability of apps to sync with such devices would further inform the evaluation of weight loss and diet apps.



### 8.3 RESEARCH KEY FINDINGS

This section represents the key findings from this research that developed from the interpretation and discussion of the initial findings from Chapters 4, 5, 6, and, 7. This research has resulted in 14 initial findings. Section 8.2 has shown the relationship between the research initial findings as well as demonstrating answers to the research objectives, which in turn provides answers to the research question.

The research question is as follows:

#### **How can a usability framework inform download popularity of socially focused wellness smartphone applications?**

There was one main outcome that has led to three key findings that answers the research question. The main outcome and the three key findings are as follow:

- ✓ **KO:** This research has developed a justified weight loss and diet smartphone apps evaluation framework, which is suitable for evaluating weight loss and diet smartphone apps.
- ✓ **KF 1:** the most downloaded iTunes and Google Play apps are not necessarily are the most usable and effective apps.
- ✓ **KF 2:** The search algorithm for iTunes and Google Play is biased towards apps title keywords that do not accurately define the real function of the application.
- ✓ **KF 3:** *Ease of Use, Reminder, Bar Code Scanning, Motivation, Usable for All, and Synchronisation\** are important elements that should be included in weight loss and diet smartphone apps and thus in the weight loss and diet evaluation framework.

### 8.4 CHAPTER REFLECTION

This chapter has reintroduced the research question and the associated objectives and demonstrated the answers to the objectives of the research. The answer to the research question and the associated objectives has been produced from all stages of this research (see Chapter 4, 5, 6, and 7). It has presented the key outcome and the three key findings of this research that answers the research question.

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\* For definitions refer to section 7.2.3 in Chapter 7.



Chapter Nine  
CONCLUSION &  
FUTURE WORKS

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## 9. CONCLUSION AND FUTURE WORKS

### 9.1 INTRODUCTION

This chapter concludes the thesis and provides a brief summary of the main outcomes. The chapter then demonstrates the research contribution to IS discipline field. It concludes with presenting the research limitations and suggestions for future work. The chapter involves the following sections:

- Section 9.2 presents a summary of the main findings of this research.
- Section 9.3 demonstrates the contribution of this research that has made to the discipline of IS.
- Section 9.4 outlines the limitations of this research.
- Section 9.5 suggests plenty of opportunities for future research.

### 9.2 SUMMARY OF THE RESEARCH FINDINGS

Chapter 4 identified the most popular iTunes and Google Play apps according to the research inclusion criteria. These apps were the only apps that were considered in the analysis of this research. The total number of included iTunes and Google Play apps was 51 (Appendix 8 and 10). This Chapter also resulted in several initial findings that showed that the search algorithm of iTunes and Google Play stores is biased towards apps titles keywords.

Chapter 5 presented the developed weight loss and diet evaluation framework. The developed weight loss and diet evaluation framework followed the evaluating method of Breton et al. (2009). The elements of the evaluation framework were identified using a content analysis of several wellness apps evaluation studies. The following were the elements of the evaluation framework: *Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, Comprehensive, Index score.*

Chapter 6 provided a detailed presentation of the findings from applying the developed evaluation framework on the identified iTunes and Google Play apps. The main initial findings of applying the evaluation framework to iTunes and Google Play apps were as follow:

- None of the iTunes and Google Play apps achieved highest proposed index score value (i.e. 11).
- iTunes and Google Play apps search algorithm is biased towards apps titles keywords that do not accurately identify the real function of apps (Initial Finding 1 and 2).
- The elements of the developed evaluation framework have been found in at least one or more iTunes and Google Play apps except the ‘*Comprehensive*’ element, which was not found in any Google Play apps (Initial Finding 3 and 4).
- The proportion of iTunes and Google Play apps below the average was more than the proportion of apps above than average (Initial Finding 5)

Chapter 7 presented the outcomes of the deductive thematic analysis of iTunes and Google Play apps user reviews. The main initial findings that resulted from this chapter were as follow:

- There were 11 emerged categories that resulted from the thematic analysis of the user reviews related to the elements of the evaluation framework (*Monitoring User Data, Social Support, Knowledge Resource, Weight Loss Goal, Regular Physical Activity, Abstract and Reflective, Public, Aesthetic, Controllable, Trending and Historical, Comprehensive* and *Index score*) (Initial Finding 1).
- In addition, 12 unrelated thematic categories resulted from the deductive thematic analysis of the apps user reviews. These unrelated categories were as follows: *Synchronisation, Feelings, Bar code Scanning, Usable for All, Reminder, Annoying Ads, Motivation, Improvement Suggestions, App Cons, App Pros, Ease of Use, and Recommended* (Initial Finding 2).

- All the elements of the developed evaluation framework were found as thematic themes in the iTunes and Google Play user reviews at least once (Initial Finding 3).
- Analysing iTunes and Google Play users reviews resulted in more ***Related Categories*** found in Google Play user reviews than iTunes user reviews, as the number of Google Play user reviews was higher than iTunes reviews (Initial Finding 4).

Chapter 8 presented the connections between all the main initial findings of the research (Chapter 4, 5, 6, and 7) and, as result has answered the research objectives and thus the question. The main key findings of this research are as follows:

- ✓ **KO:** This research has developed a justified weight loss and diet smartphone apps evaluation framework, which is suitable for evaluating weight loss and diet smartphone apps.
- ✓ **KF 1:** the most downloaded iTunes and Google Play apps are not necessarily are the most usable and effective apps.
- ✓ **KF 2:** The search algorithm for iTunes and Google Play is biased towards apps title keywords that do not accurately define the real function of the application.
- ✓ **KF 3:** *Ease of Use, Reminder, Bar Code Scanning, Motivation, Usable for All, and Synchronisation* are important elements that should be included in weight loss and diet smartphone apps and thus in the weight loss and diet evaluation framework.

### 9.3 RESEARCH CONTRIBUTIONS

#### 9.3.1 Substantive Level

At the substantive level, the thesis has evaluated weight loss and diet smartphone apps, thus providing an opportunity to demonstrate the results of these evaluations of weight loss and diet apps from the Australian iTunes and Google Play markets (see Chapter 6). The evaluation of the downloaded apps by the developed framework has demonstrated that, according to this research, the popularity of apps does not always reflect the usability and effectiveness of the app.

### 9.3.2 Methodological Level

At a methodological level, this research provides a contribution as it combined multiple data collection and data analysis techniques that form an innovative approach to overcome the methodological limitations that would have resulted from a single method. The weight loss and diet evaluation framework was developed using a content analysis of the literature. In addition, this research has applied the evaluation framework on iTunes and Google Play apps and then combined the outcomes that resulted from stage three - **application of evaluation framework** with a deductive thematic analysis of apps' users reviews. The thematic analysis of users reviews provided support to the outcomes that resulted from applying evaluation framework to iTunes and Google Play apps and emphasised the usability elements of the evaluation framework.

### 9.3.3 Theoretical Level

Finally, this research has contributed at the theoretical level. The thesis identifies that there are two main styles in the literature to evaluate smart phone apps (see section 2.4). This research supports the apps evaluation approach advocated by Breton et al. (2009). Also, this research identifies evaluation elements based on current literature (see section 5) that is suitable to evaluate weight loss and diet apps. In addition, this thesis contributes to improving the understanding of applying the smartphone evaluation framework on iTunes and Google Play apps.

## 9.4 RESEARCH LIMITATIONS

This section considers the limitations of this research and presents the tactics used to address some of the limitations.

### 9.4.1 Scope of Research

The research was of an exploratory nature and its scope aimed to provide insight on how a usability framework could inform the download popularity of socially focused health wellness mobile applications, in particular weight loss and diet apps. However, the research has focused only on apps related to weight loss and diet that have been identified according to specific inclusion criteria and hence the developed evaluation framework is not applicable to all types of apps.

### 9.4.2 Researcher Bias

The subjective nature of qualitative research makes it vulnerable to bias from the researcher (Denzin and Lincoln 2005). The research has included multiple data collection and analysis techniques to reduce the influences of bias on this research.

### 9.4.3 Number Of Apps and Reviews Included In The Analysis

As qualitative research requires more time for collecting research data compared with quantitative research (Johnson and Onwuegbuzie 2004; Anderson, 2010), the time constraint of this study, which was considered short (6 months), restrained the researcher to reduce the number of apps that were included in the analysis. Therefore, the number of iTunes user reviews was very small, which led to not fully saturated thematic categories and many repeated thematic categories (such as App Cons).

## 9.5 FUTURE RESEARCH

Future research could be conducted to build on the findings of this research. Future use of the evaluation framework would benefit from more than one single application. It is suggested that the framework be applied by more than one evaluator/iteration. This can overcome the limitation of researcher bias.

A longitudinal study or study with greater time and resources can include more apps and user reviews and thus give more accurate results.

This research has focused merely on evaluating iTunes' and Google Play's most popular apps. However, there is an opportunity for research to evaluate popular apps and unpopular apps to compare their results. Likewise, as this research has focused only on evaluating high rating apps, another research could consider the evaluation of high rating and low rating apps. Such research could discover if there was a relationship between high and low rating apps and the index scores gained by the evaluated apps.

In the thematic analysis phase, the number of analysed iTunes and Google Play user reviews was relatively small as it was restricted by the time constraints of this research. A greater number of user reviews would give more accurate results. In addition, thematic analysis resulted in thematic categories that were not included as elements of the developed evaluation framework such as *Ease of Use*, *Reminder*, *Barcode Scanning*, *Motivation*, *Usable for All*, and *Synchronisation*. Adding these

elements may result in a more robust weight loss and diet apps evaluation framework as the literature has agreed on their importance. These elements were not included in the developed evaluation framework. The thematic analysis has demonstrated the importance of the *Reminder* element in the weight loss and diet evaluation frameworks, which was initially overlooked in the developed framework since evaluating this element for all apps would require an extended amount of time. Thus, incorporating this element in the weight loss and diet evaluation framework is vital.

### 9.6 CONCLUDING REFLECTION

This last chapter of the thesis has highlighted the main findings of the research. In addition, it demonstrated the substantive, methodological, and theoretical contributions of the research. This chapter also has outlined the limitations of the research and highlighted some of the tactics that taken to overcome some of the research limitations. This chapter has concluded by providing several opportunities for future research.

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# Appendices

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## 11. Appendices

### Appendix 1

The top popular 30 apps collected on 25 June 2014 from Australian iTunes store by using the search term “weight loss”.

<b>Selective Review of iTunes Apps 1- Top Popular 30 Apps resulted from the search term “weight loss”</b>	
1.	My Diet Coach- Weight Loss for Women (© 2012 InspiredApps)
2.	Weight Loss (© ModiFace Inc.)
3.	Lose Weight not lose mind: 1000+ Weight Loss Secrets (© atoz)
4.	Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution (©2013 everyday Health Inc.)
5.	Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss (© 2013, MapMyFitness, Inc.)
6.	Lose the Belly (Weight Loss for Women) (©2013 Pacific Spirit Media Inc.)
7.	Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... (©Surf City Apps LLC)
8.	Weight Loss Hypnosis by Mindifi- Lose Fat with Better Health and Meditation (©Mindifi)
9.	Best Diet Foods! Weight Loss Food Tips For Easy Healthy Eating (© 2014 Michael Quach)
10.	Easy Weight Loss Tips! Best Diet Tracker & Mobile Diet Plan (© 2013 Michael Quach)
11.	Calorie Counter & Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)
12.	Nutricise-Meal Planner & Weight Loss Programs (©2013 Nutricise Pty Ltd)
13.	MyFit Fitness- Workout Loger and Weight Loss Exercise Tracker Free (©MyFit Fitness Inc)
14.	Weight Loss! (©Zky)
15.	Weight Watchers Mobile AU (©2013 Weight Watchers International Inc.)
16.	Healthy Recipes: Cooking for Fast Weight Loss (©2010 Pacific Spirit Media 2010)
17.	Nexercise- motivation to lose weight, to finally meet your weight loss & health goals (© 2014 Nexercise Inc.)
18.	TactioHealth (Weight Loss, Fitness, Hypertension & Diabetes Family eHealth Tracking System) (©2011-2014 Tactio Health Group Inc. )
19.	Happy Scale:Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log...(© Front Pocket Software LLC)
20.	Walkmeter GPS Pedometer- Wlaking Running Hiking for weight Loss Wlak Tracker (©2014 Abvio Inc.)
21.	Diet Shakes- For fat burning & weight loss that builds lean muscle (©2011-2012 Our3Wishes)
22.	Virtual Weight Loss Model Lite (©2009 Pacific Spirit Media Inc.)
23.	Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss \$3.79 (© 2013, MapMyFitness, Inc.)
24.	Weight Loss for Men (Lose the Belly) (©2013 Pacific Spirit Media Inc.)
25.	Diet Tips Free! Best Diet Tracker App, Beauty Diet Plans, Easy Weight Loss For Women & Men (©2014Michael Quach)
26.	Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss (©2012-2013 Clear Sky Apps Ltd)
27.	Situps 0 to 200: sit ups Workout Trainer, Abs exercise pro to help weight loss (©2012-2013 Clear Sky Apps Ltd)
28.	Your Ideal Weight: Calculator for your losing diet (©MOVISOL Media S.L.)
29.	Lose Weight with FitFrnd-The Best Weight Loss, Diet and Daily Fitness Tracker. Use for Running Walking Cycling and 230 Sports Strngth &Core (©2012 Durga P Pandey)
30.	Diet Buzz-Weight Loss Dieting Plans, Recipes, Healthy Foods & Fat Burning Tips- Free mobile app (©Joe Sriver)

## Appendix 2

The top popular 30 apps collected on 25 June 2014 from Australian iTunes store by using the search term “diet”.

<b>Selective Review of iTunes 2- Top Popular 30 Apps resulted from the search term “diet”</b>	
1.	Calorie Counter & Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)
2.	My Diet Coach – Weight Loss for Women (© 2012 InspiredApps)
3.	Low Fat Recipes- Diet, Lose Fat, Lose Weight (© AC)
4.	Australian Calorie Counter- Easy Diet Diary (© 2013 Xyris Holdings Pty Ltd)
5.	Your Ideal Weight: Calculator for your losing diet (© MOVISOL Media S.L)
7.	Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss (© 2013, MapMyFitness, Inc.)
8.	MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health (© LIVESTRONG.COM)
9.	Best Diet Foods! Weight Loss Food Tips For Easy Healthy Eating (© 2014 Michael Quach)
10.	My Diet Diary- Your Personal Calorie Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking (© 2012-2014 MedHelp)
11.	Calorie Counter and Diet Tracker by Calorie Count (© 2012 About, Inc.)
12.	Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... (©Surf City Apps LLC)
13.	Easy Weight Loss Tips! Best Diet Tracker & Mobile Diet Plan (© 2013 Michael Quach)
14.	I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet (© 2013 I feel Good Pty Ltd)
15.	Belly Fat Workout Free-10 Minute Ab Exercises (©procodemedia.com 2012)
16.	FatBooth (©2010-2013 PiVi & Co)
17.	Weight Watchers Mobile AU (©2013 Weight Watchers International Inc.)
18.	Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter (© 2014 MapMyFitness Inc)
19.	Seven Day Diet (© Techfu)
20.	Happy Scale:Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log...(© Front Pocket Software LLC)
21.	CalorieKing Australia Food Search (© CalorieKing Wellness Solutions, Inc.)
22.	Nutrition Quize: 600+Facts, Myths & Diet Tips for Healthy Living (©2013 runtastic GmbH)
23.	Diet Shakes- For fat burning & weight loss that builds lean muscle (©2011-2012 Our3Wishes)
24.	Fatify- Get fat (© Apptly LLC)
25.	Diet Tips Free! Best Diet Tracker App, Beauty Diet Plans, Easy Weight Loss For Women & Men (©2014Michael Quach)
26.	Fitbit (© 2014 Fitbit, Inc.)
27.	Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)
28.	Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss \$3.79 (© 2013, MapMyFitness, Inc.)
29.	Best Diet Foods- how to keep fit with diet (© zky)
30.	The Monash University Low FODMAP Diet (© 2012 Monash University)

### Appendix 3

Google Play apps that resulted from the search term “weight loss” on 26 June 2014.

	App Name	Developer	Downloads
1	Diet Assistant - Weight Loss	Alportela Labs -	1,000,000 - 5,000,000
2	My Diet Coach - Weight Loss	InspiredApps (A.L) LTD	1,000,000 - 5,000,000
3	Effective Weight Loss Guide	naveeninfotech	100,000 - 500,000
4	Noom Weight Loss Coach	Noom Inc.	10,000,000 - 50,000,000
5	Monitor Your Weight	Husain Al-Bustan	500,000 - 1,000,000
6	Nexercise = fun weight loss	Nexercise	500,000 - 1,000,000
7	Diet Plan - Weight Loss 7 Days	Gamebaby	50,000 - 100,000
8	Weight Loss Tracker - RecStyle	Recruit Holdings Co.,Ltd.	500,000 - 1,000,000
9	BMI Calculator -Weight Loss	smayer.net	5,000,000 - 10,000,000
10	Diet Point · Weight Loss	DietPoint Ltd.	1,000,000 - 5,000,000
11	Yoga for Weight Loss	Sally Tam	50,000 - 100,000
12	Weight Loss Hypnosis	Mindifi	50,000 - 100,000
13	Weight Loss Dance Workout	PocketFitness	10,000 - 50,000
14	Weight Tracker weight loss app	cryofy.com	1,000,000 - 5,000,000
15	43 Best Foods for Weight Loss	Insplisity	100,000 - 500,000
16	Weight Loss Diet Plan	Health Club	100,000 - 500,000
17	Weight Loss	VelBrothers	50,000 - 100,000
18	101 Weight Loss Tips	Programmerworld	100,000 - 500,000
19	63 Simple Weight Loss Tips	Insplisity	10,000 - 50,000
20	Fast weight loss	MobGamesbyOnline	10,000 - 50,000
21	Weight Loss	ModiFace	50,000 - 100,000
22	Weight Loss Tracker	Matthew Wood	100,000 - 500,000
23	Weight Loss Smoothies	Sports News Apps	10,000 - 50,000
24	Restaurant Weight Loss	ellisapps Inc.	10,000 - 50,000
25	Fitocracy Workout Fitness Log	Fitocracy, Inc	100,000 - 500,000
26	BMI Calculator - Weight Loss	Przemysław Słota	500,000 - 1,000,000
27	Easy Weight Loss DM	Hypnotherapist Direct Ltd	10,000 - 50,000
28	7 Day Weight Loss 2000 KCal	Freaky Apps	10,000 - 50,000
29	Simple Weight Loss Resolution	Simple Health Apps	100,000 - 500,000
30	Hypnosis for Weight Loss	Vista Concepts. LLC	10,000 - 50,000
31	Easy Weight Loss	GLOBUS	100,000 - 500,000
32	Yoga for Weight Loss I (PRO)	DailyYoga Inc	100,000 - 500,000
33	FREE Weight Loss Hypnosis	Code Sanctuary	10,000 - 50,000
34	Weight Loss recipes	Venture Technology Ltd	50,000 - 100,000
35	Green Tea and Weight Loss	Richard Cerdan	10,000 - 50,000
36	Fast Food Nutri. & Weight Loss	Awesomeappscenter LLC	10,000 - 50,000
37	Fat Burning and Weight Loss	Filipp Kungur	10,000 - 50,000
38	Calculator for Weight Loss	ellisapps Inc.	10,000 - 50,000
39	Valentine's Weight Loss	Noom Inc.	100,000 - 500,000
40	Weight Loss & Healthy Foods	ZaleBox	100,000 - 500,000
41	Weight Loss Affirmations!	New Life Ministries	100 - 500
42	Weight Loss Tips	Stanislav Bardyuk -	50,000 - 100,000
43	Weight Loss Yoga	Xlratech Software Solutions	50,000 - 100,000
44	100 Weight Loss Tips	Richard Cerdan	50,000 - 100,000
45	Weight Loss Calculator	Health engineers team	5,000 - 10,000
46	Yoga for Weight Loss Samif	InfoMedia Pvt.Ltd	5,000 - 10,000
47	Weight Loss Calculator	jmatosjr	50,000 - 100,000
48	10 Best Weight Loss Diet Plans	Insplisity	100,000 - 500,000

49	Diet Assistant Pro-Weight Loss	Alportela Labs	10,000 - 50,000
50	Weight Loss Hypnosis-Kym	Tolson & Hani Al-Qasem -	1,000 - 5,000
51	Quick Diet · Weight Loss	DietPoint Ltd.	10,000 - 50,000
52	Weight Loss Diet & Workouts	Ravi M	10,000 - 50,000
53	Yoga for Weight Loss II (PRO)	DailyYoga Inc.	100,000 - 500,000
54	SCALES weight management	Furyu	50,000 - 100,000
55	Weight Loss Made Easy	Andro Mobile Apps	50,000 - 100,000
56	Weight loss Dodol Theme	Camp Mobile for dodol theme	10,000 - 50,000
57	Weight Loss Quotes	Mike the Android Farmer	1,000 - 5,000
58	Weight Loss Hypnosis (2 in 1!)	Code Sanctuary	5,000 - 10,000
59	Best Weight Loss Tips	MVP Apps	10,000 - 50,000
60	Weight Loss Tips In Urdu	shazz	50,000 - 100,000
61	Eatly · Weight Loss	DietPoint Ltd.	10,000 - 50,000
62	Restaurant Weight Loss LITE	ellisapps Inc.	50,000 - 100,000
63	Miracle Diet (Weight Loss)	Malezia Apps	50,000 - 100,000
64	DietTime - weight loss app	Decime.eu LTD	10,000 - 50,000
65	Weight loss Tips	AppBasic	1,000 - 5,000
66	Weight Loss Hypnosis Program	New Life Ministries	5,000 - 10,000
67	WEIGHT LOSS YOGA	HEALTH AND BEAUTY APPS	10,000 - 50,000
68	Weight Loss Mindset	Dr. Randy Gilchrist	10,000 - 50,000
69	Weight Loss Tips	Healthy Books	10,000 - 50,000
70	Weight Loss Tracker Pro	Matthew Wood	1,000 - 5,000
71	Weight Loss - Loose Weight	Health & Fitness	10,000 - 50,000
72	ELME Weight Loss	Tiny Software Factory	10,000 - 50,000
73	Weight Loss Tips	Special Daily	1,000 - 5,000
74	WeightMate Weight Loss Tracker	Babymax	1,000 - 5,000
75	Easy Weight Loss Tips	Waikiki Sky	10,000 - 50,000
76	Weight Loss Tracker	Healthy Books	10,000 - 50,000
77	Weight Loss Manager	mapiko	10,000 - 50,000
78	Weight Loss Buddy	Nicholas Gabriel	5,000 - 10,000
79	ObiNo, Weight Loss Coach	Obino.in	1,000 - 5,000
80	Weight control	PanSoft	100,000 - 500,000
81	Weight Loss	MobiHypnos	100 - 500
82	Gastric Band Weight Loss	Hypnotic World Ltd	1,000 - 5,000
83	Weight Loss hypnosis	Erick Brown Hypnosis and Subliminal	1,000 - 5,000
84	Weight War	Clevapps	100,000 - 500,000
85	Simple Weight Recorder	Beyonj	500,000 - 1,000,000
86	Weight Diary	DSD	100,000 - 500,000
87	Weight Tracker	Pig Dog Bay	50,000 - 100,000
88	Yoga for Weight Loss	Saagara	100 - 500
89	Weight Loss Calculator	PIM Team	5,000 - 10,000
90	WLAP - Weight Loss App	Pendula IT	5,000 - 10,000
91	TLS Weight Loss	Shop Mobile	1,000 - 5,000
92	Fast Weight Loss	Erick Brown Hypnosis and Subliminal	100 - 500
93	Weight Loss Smoothies Recipes	Classic Books	5,000 - 10,000
94	Calorie Counter-Weight Loss	Tekneeka	5,000 - 10,000
95	How to Lose Weight 🍌 Loss Tips	AtomicApps	10,000 - 50,000
96	Weight Loss Hypnosis	Richard Butler	5,000 - 10,000
97	Weight Loss	Appveo, LLC	1,000 - 5,000
98	Weight Loss Tips	Pixler Productions -	1,000 - 5,000
99	Sleep Cycle Weight Loss Alarm	HJStue MD, PhD	500 - 1,000



100	Weight Loss by Yoga	3i0haza2d	1,000 - 5,000
101	Yoga for Weight Loss in Hindi	Veda Studio	1,000 - 5,000
102	Weight Loss Motivation	PositivePerks	5,000 - 10,000
103	Hypnosis for Weight Loss FREE	Pro Code Media	10,000 - 50,000
104	Weight Loss HQ	Nick Staab	5,000 - 10,000
105	Diet Memo~for weight loss	Linever Corporation	10,000 - 50,000
106	Quick Weight Loss	MobiHypnos	100 - 500
107	Hypnosis for Weight Loss Audio	Alan Corp	1,000 - 5,000
108	Diets for losing weight	STR LABS	500,000 - 1,000,000
109	Calorie Clock Weight Loss	Excess Red Studios	5,000 - 10,000
110	Fast Weight Loss	Indy Mobile Designs	100 - 500
111	Weight loss Tips	IT Brains	5,000 - 10,000
112	Weight Loss	appsbar jovan -	1,000 - 5,000
113	Weight Loss Diet	7cTech -	1,000 - 5,000
114	Weight Loss Soup Recipes	Microbay Advanced Apps	5,000 - 10,000
115	Weight Loss Free	Tech CogniZous	1,000 - 5,000
116	~KILOKU~Support weight loss	SEPTENI CROSSGATE CO.,LTD.	1,000 - 5,000
117	Weight Chart	portstrom.com	50,000 - 100,000
118	Weight Loss: Miracle Diet	Malezia Apps	10,000 - 50,000
119	Pts Plus Weight Diary +	Frippware	50,000 - 100,000
120	Weight Tracker ++	jucdejeb	10,000 - 50,000
121	Weight Loss for men	Richard Butler	1,000 - 5,000
122	Paleo Diet for Weight Loss	Insplisity	1,000 - 5,000
123	Weight Loss Workouts	Picha Apps	1,000 - 5,000
124	Weight Loss Plan	Social Forefront	1,000 - 5,000
125	Weight Loss Calc	Kevin Zahri	5,000 - 10,000
126	Teens Weight Loss Tips	InfoApps247	5,000 - 10,000
127	Fast Weight Loss Tips FREE	Wisefather	10,000 - 50,000
128	Weight Loss Calorie Manager	Jump Start Marketing Inc.	1,000 - 5,000
129	Fasting For Weight Loss	Demetre Ellison	500 - 1,000
130	Healthy Weight Loss	Melih Açıkgoz	1,000 - 5,000
131	Healthy Weight Loss	Melih Açıkgoz	1,000 - 5,000
132	Slim Waist Weight Loss Workout	Fitivity	1,000 - 5,000
133	Weight Journal	Happy Shiny	5,000 - 10,000
134	Keep Weight Loss	Workpiles	1,000 - 5,000
135	Weight Loss Tips	AvB Tech	100 - 500
136	Weight Loss Menu	Zero Zone Labs	1,000 - 5,000
137	Extreme Weight Loss Hypnosis	Erick Brown Hypnosis and Subliminal	100 - 500
138	Superfoods for Weight Loss	Robert Haba	1,000 - 5,000
139	Simple Weight Loss Recipes	bigo	5,000 - 10,000
140	Weight Loss Tips	Super Tips Apps	5,000 - 10,000
141	Weight Loss By Eating	bigo	5,000 - 10,000
142	Ideal weight	MobilPlug	100,000 - 500,000
143	Weight Loss Shakes	iMobilr Apps	1,000 - 5,000
144	Weight Loss Zone	VelBrothers	100 - 500
145	99 Weight Loss Tips FREE	It's Cool!	1,000 - 5,000
146	Weight Loss Motivation	ThousAndroid	100 - 500
147	Universal - Weight Loss Yoga	Saagara	1,000 - 5,000
148	Weight Loss Calculator	Unlimited Ideas	1,000 - 5,000
149	Hypnosis - Weight Loss (M)	Nimue	100 - 500



150	Calorie counting & weight loss	Darren Gates	500 - 1,000
151	Weight Loss Workouts & Diet	Mobileapptray	5,000 - 10,000
152	101 Weight Loss Ideas	Chourishi Systems	5,000 - 10,000
153	Weight Tracker	3qubits	100,000 - 500,000
154	Weight Loss Tips	Health Club	500 - 1,000
155	Weight Loss Recipes	VR Development	100 - 500
156	Weight Loss Shortcut	Yecel	1,000 - 5,000
157	Daniel Fast Weight Loss	InfoApps247	500 - 1,000
158	Hypnosis OTR – Weight Loss	Subconscious Training Corporation	100 - 500
159	Weight Loss In a Week	Appnok.com	1,000 - 5,000
160	DietCalendar Free(weight)	GalleryApp	500,000 - 1,000,000
161	Juicing For Weight Loss	OnTimeApps	1,000 - 5,000
162	WalkTheDog Fitness Weightloss	kreativsinn	50,000 - 100,000
163	My Weight Loss Manager	Gregory Carpentier	100 - 500
164	Weight Loss Surgery Forum	ForumRunner	1,000 - 5,000
165	Weight Loss Diet Plan	TopFreeAppsTips	100 - 500
166	fitness weight lose	theblueteam	100 - 500
167	Weight Loss Recipes !	EclipseBoy	1,000 - 5,000
168	Juicing For Weight Loss	Charizma Pub	1,000 - 5,000
169	Chat Weight Loss	Exciting Game	500 - 1,000
170	Weight Loss In A Week Exercise	EliteApps	5,000 - 10,000
171	Weight Loss Buddy	JennTech Inc Internet Services	10 - 50
172	Natural Weight Loss App	BM Apps	1,000 - 5,000
173	Weight Loss Now	BantoRad	100 - 500
174	Weight Loss Quotes Pro	Mike the Android Farmer	50 - 100
175	Ultimate Weight Loss Hypnosis	Bright Light Apps Pty. Ltd.	100 - 500
176	Weight Loss And Diet Guide	EBeuvaliers	5,000 - 10,000
177	Sensa Review - Weight Loss	WebDiver	1,000 - 5,000
178	7 Day Weight Loss Plan	Health Club	1,000 - 5,000
179	Weight Loss	SLIC Marketing Solutions	100 - 500
180	Quick weight loss, tips 2014	Charizma Pub	1,000 - 5,000
181	Gym Goals-Simulate Weight Loss	Yucca Mobile LLC	1,000 - 5,000
182	Weight Loss Tips	Casags Mktng	1,000 - 5,000
183	Extreme Weight Loss Secrets	KoolAppz	100 - 500
184	Lazy Diet Weight Loss System	Wayne Hagerty	100 - 500
185	Weight Loss Fat Burner	Hypnosis, Meditation and Coaching Group, LLC	50 - 100
186	Fast Weight Loss Tips	Dnvgoods	1,000 - 5,000
187	Javita Weight Loss Coffee	Your Mobile Media Consultants	100 - 500
188	Weight Loss Gold	GoldStar App	50 - 100
189	Weight Loss Drinks	Junk Blogger Apps	500 - 1,000
190	Weight Loss Tips	KoolAppz	10 - 50
191	Weight Loss Brain Entrainment	Richard Butler	500 - 1,000
192	Weight loss	KaraVR app	100 - 500
193	Easy Weight Loss Sounds	Reliax	100 - 500
194	Weight Loss Calculator Dietica	Dream Solutions Ltd.	100 - 500
195	Weight Loss Buddy: RMR BMR	Jason Webb	1,000 - 5,000
196	Yoga for Weight Loss	MyAppsCoder	1,000 - 5,000
197	Weight Loss Success hypnosis	Hypnosis, Meditation and Coaching Group, LLC	50 - 100
198	Weight Loss Tips	Mukesh	100 - 500
199	Weight Loss Mentality	KoolAppz	10 - 50
200	How to Weight Loss	Derek Shu	500 - 1,000

201	Weight Loss Calculaor Pro	Health engineers team	10 - 50
202	How to lose weight	Reliablesoft.Net	100,000 - 500,000
203	Weight Loss Free Useful Tips	georges Louis	1,000 - 5,000
204	Weight Loss Diary	abletFactory	500 - 1,000
205	Weight Loss Secrets	KoolAppz	10 - 50
206	Weight Loss Month	Breaking Art	10 - 50
207	Fast Food & Weight Loss LITE	Awesomeappscenter LLC	5,000 - 10,000
208	Weight Loss Theta Hypnosis	Multiformis	100 - 500
209	Weight Loss Exercises	devnitiya	100 - 500
210	Weight Loss Secrets	Tom Pou App	100 - 500
211	Weight Loss Tips	Carnivalbd.com	50 - 100
212	Hypnosis- Weight Loss	Jessica Buckley	10 - 50
213	How To Lose Weight Fast	Venture Technology Ltd	100,000 - 500,000
214	Weight Loss Hypnosis	Turnt Apps LLC	10 - 50
215	Track my weight	Japps Medical	50,000 - 100,000
216	Weight Loss Tips	JASS	10 - 50
217	Subliminal Weight Loss Night	Healthy Visions	10 - 50
218	Weight loss tips	Toru Mobile	100 - 500
219	Weight Loss 7 Days Diet Plan	NC Studio	1,000 - 5,000
220	Half Size Me Weight Loss Coach	Standish Media LLC	10 - 50
221	Weight Loss	Aspiring Investments Corp	5 - 10
222	Weight Loss Tips	App Fondue	100 - 500
223	Weight Loss Maintenance	Vista Concepts. LLC	100 - 500
224	Fasting Diets for Weight Loss	New Reach Apps	1,000 - 5,000
225	Weight Loss Exercise Video	Q Apps	100 - 500
226	Healthy Weight Loss	WebSocialMania	100 - 500
227	Weight Loss Affirmations	Drentek	100 - 500
228	Weight Loss Tips	NANA APPS	100 - 500
229	Weight Track Assistant	Kevin Tung	100,000 - 500,000
230	Best Weight Loss Tips	pnpdevlopers	500 - 1,000
231	Weight Ticker	Tamtris Web Services Inc	10,000 - 50,000
232	Weight Loss Diet	Appveo, LLC	100 - 500
233	Atkins Diet Weight Loss FREE	Mew Apps	500 - 1,000
234	Spiritual Weight Loss	Appnok.com	10 - 50
235	Weight Loss Buddy	The Best of Best Apps	100 - 500
236	Holiday Weight Loss Tips	BookAndroid	500 - 1,000
237	Weight Loss Top Secrets	DeevProfessional	100 - 500
238	How To Lose Weight Quickly	Venture Technology Ltd	100,000 - 500,000
239	Simple Weight Loss Recipes	WebSocialMania	500 - 1,000
240	Weight Loss Surgery Channel	GWHQ Productions LLC	1,000 - 5,000
241	Weight management book	Junichiro Mori	1,000 - 5,000
242	Max Weight Loss System	MaxIntl	100 - 500
243	Weight Loss Hypnosis Set	JennTech Inc Internet Services	10 - 50
244	Weight Loss Audio Program	Leigh Spusta	10 - 50
245	EasyFoods for Weight Loss	It's Cool!	100 - 500
246	Weight Loss after Pregnancy	KoolAppz	10 - 50
247	Weight Loss Nutrition	Rudo Zavala	100 - 500
248	Weight Loss Helper	Powers Apps	100 - 500
249	Fast Weight Loss	Jere Parker	1 - 5
250	Weight Loss	Tech CogniZous	1 - 5

## Appendix 4

Google Play apps resulted by using the search term “diet” on 1 July 2014.

	App Name	Developer	Downloads
1	My Diet Coach - Weight Loss	InspiredApps (A.L) LTD	1,000,000 - 5,000,000
2	Diet Assistant - Weight Loss	Alportela Labs	1,000,000 - 5,000,000
3	My Diet Diary Calorie Counter	MedHelp, Inc - Top Health Apps	1,000,000 - 5,000,000
4	Calorie Counter - MyFitnessPal	MyFitnessPal, Inc.	10,000,000 - 50,000,000
5	Diet Point · Weight Loss	DietPoint Ltd.	1,000,000 - 5,000,000
6	The 90 Day Diet	Susanne Kessler	100,000 - 500,000
7	Blood Type Diet +	DooZee Apps	10,000 - 50,000
8	Diet Plan	AB Mobile Apps	100,000 - 500,000
9	Water Diet	Synerve	10,000 - 50,000
10	GM Diet Plan	Health Experts	10,000 - 50,000
11	Diets	CMR Paradise	50,000 - 100,000
12	Woman's DIARY period · diet · cal	HighLab Co.,Ltd.	1,000,000 - 5,000,000
13	Japanese Diet	Webest	50,000 - 100,000
14	Diet Diary ( Diet Calendar )	EONSOFT	100,000 - 500,000
15	Belly Fat Burning Diet plan	Ravi M	50,000 - 100,000
16	Weight Loss Diet Plan	Health Club	100,000 - 500,000
17	Diets for losing weight	STR LABS	500,000 - 1,000,000
18	The Monash Uni Low FODMAP Diet	Monash University Low FODMAP diet team	5,000 - 10,000
19	Atkins Carb Tracker	Atkins Nutritionals	100,000 - 500,000
20	DIET	Mobiem	50,000 - 100,000
21	Calorie Counter PRO MyNetDiary	MyNetDiary.com	100,000 - 500,000
22	My Diet Coach - Pro	InspiredApps (A.L) LTD	50,000 - 100,000
23	OneStep Diet	NHK ENTERPRISES, INC.	500,000 - 1,000,000
24	Photo diet	SukutaSystem	100,000 - 500,000
25	Diet Pembakaran Lemak	T.Awadh	5,000 - 10,000
26	Diet Viewer	Yuichi Uchida	10,000 - 50,000
27	Diet Planner	MYRIAS	10,000 - 50,000
28	Dukan Diet	SnM.com	5,000 - 10,000
29	Paleo Diets & Recipes	ProsperTrack	100,000 - 500,000
30	Diet Pedometer	ACONTECH	100,000 - 500,000
31	Diet Tips	Waikiki Sky	10,000 - 50,000
32	Diet Chart	Apps Court	10,000 - 50,000
33	Diet Watchers Diary	Croc Software	10,000 - 50,000
34	Diet Memo	dot-i studio	10,000 - 50,000
35	Pregnancy Diet!	bigo	50,000 - 100,000
36	17 Day Diet	Womens Diet Network	1,000 - 5,000
37	Blood Type Diet	TungLabs	50,000 - 100,000
38	Diet Plan - Weight Loss 7 Days	Gamebaby	50,000 - 100,000
39	Diet Book	Technology Wisdom	10,000 - 50,000
40	Diet Plans Best Diets Recipes	LongRunApps	50,000 - 100,000
41	Paleo Diet Plan	Health Experts	10,000 - 50,000
42	hCG Diet	appilicious	5,000 - 10,000
43	Scarsdale Diet	Mihail Velikov	10,000 - 50,000
44	Bodybuilding Diet	Next apps team	10,000 - 50,000

45	South Beach Diet	Everyday Health	100,000 - 500,000
46	Pedometer Walking Diet	VALSIOR Co., Ltd.	100,000 - 500,000
47	M-Diet Helper	Nister Co.,Ltd.	100,000 - 500,000
48	hCG Diet +	appilicious -	1,000 - 5,000
49	Famous Diets	HallandSoft -	5,000 - 10,000
50	my Diet Journal	Harvey G. Payne	100,000 - 500,000
51	Miracle Diet Guide	Vosh	10,000 - 50,000
52	All Diets	Yoav Fael	10,000 - 50,000
53	Diet Camera	CONNIE	100,000 - 500,000
54	Diet Time	funweaver	50,000 - 100,000
55	Cara Diet Alami	Mahapedia	10,000 - 50,000
56	Diabetes Diet	bigo	10,000 - 50,000
57	Diet Deddy Corbuzier	Mahapedia	10,000 - 50,000
58	Diet Manager	The Blue Skylab	10,000 - 50,000
59	Diet Watcher Cookbook	Webcipe	100,000 - 500,000
60	100 days Diet	aple	100,000 - 500,000
61	Chien Binh Diet Quy	SNIPER SHOOTING	100,000 - 500,000
62	The Blood Type Diet®	North American Pharmacal, Inc.	10,000 - 50,000
63	90 Days Diet	Mihail Velikov	50,000 - 100,000
64	Diet Tips	DodsonEng	10,000 - 50,000
65	Diet	Andro R2D2	1,000 - 5,000
66	Diet	KIM HYEON JU	500 - 1,000
67	Diet Timer Fast Way XXL - >Slim	ExaMobile S.A.	10,000 - 50,000
68	DietShin-diet 청혈주스 레시피	Diet&Calorie	100,000 - 500,000
69	3 Day Easy Diet app	App2Shop	100,000 - 500,000
70	Carbs & Cals - Diabetes & Diet	Chello Publishing Limited	10,000 - 50,000
71	Doc's Diet Diary	Bearcat Global LLC	50,000 - 100,000
72	Manage your weight and diet	KrAndroid	100,000 - 500,000
73	Detox Diet - Detox Diet Easy	iJavDep	5,000 - 10,000
74	Pregnancy Diet Calculator	Strategem iLabs	50,000 - 100,000
75	Bodybuilding Diet - Pro	Zen Software, LLC	1,000 - 5,000
76	Gaining Weight Diet	Mihail Velikov	10,000 - 50,000
77	Zombie Diet	Micro Lab	10,000 - 50,000
78	Juice Diet Recipes	Chrud Software	1,000 - 5,000
79	Scarsdale diet	Daniele Ravizza	1,000 - 5,000
80	my Diet	Volter	10,000 - 50,000
81	Chokotto Diet	Hideki Ogawa	10,000 - 50,000
82	iDukan Dukan Diet Tracker	Harptree Software	10,000 - 50,000
83	Bodybuilding Diet - Lite	Zen Software, LLC	10,000 - 50,000
84	Liquid Diets	InfoApps247	1,000 - 5,000
85	audio book - diet	Twayesh Projects	50,000 - 100,000
86	Diet Plan Recipes Free	Riafy Technologies	50,000 - 100,000
87	Blood Group Diet	Quran Reading	10,000 - 50,000
88	Family Diet	Graceful Garden	10,000 - 50,000
89	Diet Assistant Pro-Weight Loss	Alportela Labs	10,000 - 50,000
90	Diet Kingdom	JOOME LEE	5,000 - 10,000
91	Japanese Miracle Diet	Mihail Velikov	10,000 - 50,000
92	OCD Diet Deddy Corbuzier	cGet Studio	10,000 - 50,000
93	DASH Diet Plan	Health Experts	1,000 - 5,000
94	Effective Diet FREE	BSdev	50,000 - 100,000
95	Diet master lite	Dietmm	5,000 - 10,000

96	10 Best Weight Loss Diet Plans	Insplisity	100,000 - 500,000
97	1200 Calorie Diet Plan	CM Project	10,000 - 50,000
98	Diet Plan	CM Project	1,000 - 5,000
99	Diet Points Calculator	Nomadic Ratio	50,000 - 100,000
100	TrackMyFast 5:2 Diet	TrackMyFast.com -	5,000 - 10,000
101	17 Day Diet	CM Project	10,000 - 50,000
102	Paleo Diet Pro	FitKit	1,000 - 5,000
103	Atkins Diet Plan	Perriander Mcrucker	5,000 - 10,000
104	Atkins Diet Recipes	Jarden Torcuato	1,000 - 5,000
105	CheckOff Diet Tracker	New Angle Technologies LLC	1,000 - 5,000
106	ayurvedic diet in hindi	freestudioworld	10,000 - 50,000
107	Be Supermodel Diet	vesuri	5,000 - 10,000
108	Point by Point - Diet Lite	AIMTecnologia	100,000 - 500,000
109	Low Carbohydrate Diet	Mihail Velikov	10,000 - 50,000
110	Dukan Diet Free	FitKit	10,000 - 50,000
111	Mediterranean Diet Plan	Health Experts	1,000 - 5,000
112	Paleo Diet	bigo	10,000 - 50,000
113	Quick Diet · Weight Loss	DietPoint Ltd.	10,000 - 50,000
114	Low - FODMAP Diet	Sean Colombo	10,000 - 50,000
115	fitness diet free app	Adcoms	10,000 - 50,000
116	Zone Diet	rooswelt	1,000 - 5,000
117	Diet Records free	hashisoft	10,000 - 50,000
118	GM Diet Free	Kamal Ravichandran	5,000 - 10,000
119	Diet Plan	Telenor Pakistan	5,000 - 10,000
120	Low Carb Diet!	bigo	10,000 - 50,000
121	IC Diet	Justin Gratton	100 - 500
122	7days Diet!Yoga & Stretch	KAWAII	5,000 - 10,000
123	Diyetkolik.com Diet & Exercise	PCI Yazilim Danismanlik ve Organizasyon Ltd. Sti.	50,000 - 100,000
124	Perfect Diet Plan	Appostrophic.com	10,000 - 50,000
125	Diet Habits Free	Dodur Ltd.	10,000 - 50,000
126	My Diet Tracker Food Diary	Mathew Giaimo	50,000 - 100,000
127	Dissociated Diet Free	ZASAMA	10,000 - 50,000
128	Diet master	Dietmm	100 - 500
129	90 Day Diet	dmbTeam	1,000 - 5,000
130	peso Free - Diet Assistant	woodsmall inc.	10,000 - 50,000
131	My Diet Diary	appwoX	10,000 - 50,000
132	DroidZonePro - Zone Diet	Federico Lettieri	10,000 - 50,000
133	Ketogenic Diet Plan	CAMPBELL7	1,000 - 5,000
134	Paleo Diet Tips.	Free App Empire	10,000 - 50,000
135	Vegetarian Diet	applelearningpurpose	1,000 - 5,000
136	4F Diet Exercises & Fitness	4Fitting	100,000 - 500,000
137	Effective Diet	BSdev	100 - 500
138	Miracle Diet (Weight Loss)	Malezia Apps	50,000 - 100,000
139	HCG Diet!	Appveo, LLC	5,000 - 10,000
140	Pregnancy Diet !	EclipseBoy	1,000 - 5,000
141	Diet Of Angel	リブラプラス株式会社	5,000 - 10,000
142	Point by Point - Diet	AIMTecnologia	1,000 - 5,000
143	Mediterrean Diet Tips	AppAddict	5,000 - 10,000
144	diet virus	Mopheous	500 - 1,000
145	Diet Buzz Launcher Theme	Daum Buzz Team	10,000 - 50,000
146	3 Day Diet	Realized Mobile	1,000 - 5,000

147	Dissociated Diet Plus	CanaroLab	5,000 - 10,000
148	Online Pedometer Diet	ACONTECH	10,000 - 50,000
149	Detox Diet	Unlimited Publishing	5,000 - 10,000
150	Tips Diet dan Makanan Sehat	ekkow	10,000 - 50,000
151	Atkins Diet Induction	Demetre Ellison	1,000 - 5,000
152	Slimming Diet	Mobile App Company	100 - 500
153	Diet Plan For Teens	Professional Health APP	1,000 - 5,000
154	Diet Calories Vitamins Counter	Healthy Lifestyle	10,000 - 50,000
155	1200 and 1500 Calories Diets	Awesomeappscenter LLC	1,000 - 5,000
156	Atkins Diet Shopping List	LISIERS MEDIA LLC	1,000 - 5,000
157	HCG Diet	Syed Wasty	100 - 500
158	Atkins Diet	Small Diet	100 - 500
159	Diet Master	R2 team	10,000 - 50,000
160	Best Diet Foods	Waikiki Sky	5,000 - 10,000
161	Dukan Diet	Unlimited Publishing	10,000 - 50,000
162	Calories and Diet	Cosmin Olariu	10,000 - 50,000
163	PKU Diet Management	Healthy Lifestyle	5,000 - 10,000
164	Summer Diet	Mihail Velikov	1,000 - 5,000
165	Fitness Body Building Diet	CosmopolitApps	5,000 - 10,000
166	Diet diary	Nori	100 - 500
167	Caveman Diet Recipes! FREE	MintMedia	10,000 - 50,000
168	Atkins Diet Handbook - Free	Qmoby	10,000 - 50,000
169	Diet Plans.	SLIC Marketing Solutions	1,000 - 5,000
170	Flat Belly Diet Plan	CM Project	5,000 - 10,000
171	Primal Paleo: the Diet Guide	Appy Ventures Ltd	1,000 - 5,000
172	Dash Diet	Venture Technology Ltd	1,000 - 5,000
173	MMA Diet	The Samurai Soul Company	100 - 500
174	Fast Diet	SnM.com	50 - 100
175	GM Diet(Vegetarian Diet Plan)	KARP Studios	1,000 - 5,000
176	The Digest Diet	RD Digital	500 - 1,000
177	7 Day Diet Meal Plan	Health Club	10,000 - 50,000
178	Diet Tracker	letsnurture	1,000 - 5,000
179	Diet Zone Calculator	Alessandro Boggiano	500 - 1,000
180	Quick Diet · Paleo	DietPoint Ltd.	100 - 500
181	Diets For Teens	DreamLandApps	1,000 - 5,000
182	Sumo Diet	Codegames Studios	500 - 1,000
183	Mediterranean Diet	Appveo, LLC	1,000 - 5,000
184	All Diets	Small Diet	10 - 50
185	My Diet Tips	Cooply Apps	1,000 - 5,000
186	My Diet	SnM.com	100 - 500
187	New Diet	War Apps And Games	500 - 1,000
188	Paleo Diet Recipes FREE	SocialGuruMe	1,000 - 5,000
189	Dukan Diet	Appveo, LLC	5,000 - 10,000
190	Diet, Weight Log/Tracker	framefever	10,000 - 50,000
191	Pregnancy Diets	Mother And Baby	100 - 500
192	Paleo Diet	Appveo, LLC	1,000 - 5,000
193	Atkins Diet	Unlimited Publishing	100 - 500
194	Paleo Diet +	Golden Cobra	1,000 - 5,000
195	Gout Diet	maroonfolder	50 - 100
196	Hungry Girl Diet Bk. Companion	Hungry Girl	5,000 - 10,000
197	Diet dodol launcher theme	iConnect	5,000 - 10,000
198	Free Paleo Diet Recipes	It's Cool!	1,000 - 5,000
199	Primal Paleo Diet Guide: Free	Appy Ventures Ltd	10,000 - 50,000



200	Weight Loss Diet & Workouts	Ravi M	10,000 - 50,000
201	Diet Express	Mobile App Company	1,000 - 5,000
202	Paleo Diet Recipes	MintMedia	10,000 - 50,000
203	Low Cholesterol Diet Lite	maroonfolder	1,000 - 5,000
204	Quick Diet · Low Carb	DietPoint Ltd.	500 - 1,000
205	Gout Diet Lite	maroonfolder	1,000 - 5,000
206	7 Day Diet Plan	Demetre Ellison	1,000 - 5,000
207	Virtual Diet	HiRo	1,000 - 5,000
208	Diet Search	MobileAppLoader	1,000 - 5,000
209	Sugar Detox Diet	TopFreeAppsTips	500 - 1,000
210	DASH DIET COOKBOOK	PvTai INC.	500 - 1,000
211	Keto Diet Plan	InfoApps247	1,000 - 5,000
212	Terri Ann's 123 Diet Plan	Terri-Ann 123 Diet Plan	1,000 - 5,000
213	Diabetic Diet Guidelines	Qmoby	1,000 - 5,000
214	Quick Diet · Detox	DietPoint Ltd.	100 - 500
215	Diet Tracker	Red Panda Studio	100 - 500
216	Coupon Diets	SteinIndex	100 - 500
217	Keto Diet Recipes	Syed Wasty	500 - 1,000
218	Glycemic Index Diet	applelearningpurpose	1,000 - 5,000
219	Ornish diet	Lavrushka	100 - 500
220	Juice Diet Recipes	CAMPBELL7	1,000 - 5,000
221	Atkins Diet Low Carb	Naman Sharma	1,000 - 5,000
222	4F2 Diet Exercises & Fitness	4Fitting	10,000 - 50,000
223	BMI + BMR diet calculator	Androcalc	10,000 - 50,000
224	5:2 Fasting Diet Recipes	Trellisys.net	1,000 - 5,000
225	Diet Watch	Studio Quipo Inc.	1,000 - 5,000
226	Quick Diet · Healthy	DietPoint Ltd.	100 - 500
227	Calorie Counter & Diet Tracker	SparkPeople	100,000 - 500,000
228	Diet graph (Free)	三島ソフト	5,000 - 10,000
229	Diet.	Daniel Rocha Lopes	50 - 100
230	Pregnancy Diet Plan	kun yit lin	1,000 - 5,000
231	Protein Diet	Unlimited Publishing	100 - 500
232	17 Day Diet	Small Diet	100 - 500
233	Protein Diet	Bapidev	100 - 500
234	Atkins Diet Carb Counter	Aggie	1,000 - 5,000
235	Atkins Diet Plan Guide	Android Ebook App Inc.	5,000 - 10,000
236	Diet Shakes Diet Bars	JIHNDEV	1,000 - 5,000
237	Diet Plan Weight Gain	Professional Health APP	500 - 1,000
238	Diet Plan For Abs	Professional Health APP	1,000 - 5,000
239	Bodybuilding Diet & Recipe	StrongBody	5,000 - 10,000
240	Sugar Smart Diet	HV Apps	1,000 - 5,000
241	Diet Info	Pradeep Kumar Paijwar	10 - 50
242	Bigger Booty Diet	favthai	1,000 - 5,000
243	Mediterranean Diet Resource	Amanda Sturmer	1,000 - 5,000
244	Low Carb Diet Plan	Shubham Ghatkar	1,000 - 5,000
245	Dukan Diet Pro - Lose Weight	FitKit	1,000 - 5,000
246	Diet	Etalongames	50 - 100
247	Vegan Diet Free	FitKit	1,000 - 5,000
248	hCG Diet Plan	EmptyBottles	1,000 - 5,000
249	Diets 4 Men	MintMedia	1,000 - 5,000
250	Low Fat Diet Lite	maroonfolder	500 - 1,000

## Appendix 5

All of possible ranges of download in Google Play that have been identified from search term “weight loss” and “diet”.

### 1. “Weight loss”

Google Play App Download Ranges	Number of apps in each rang	Formula
1 - 5	2	=COUNTIF(D2:D252,"1 - 5")
5 - 10	1	=COUNTIF(D2:D252,"5 - 10")
10 - 50	15	=COUNTIF(D3:D252,"10 - 50")
50 - 100	5	=COUNTIF(D2:D252,"50 - 100")
100 - 500	43	=COUNTIF(D2:D252,"100 - 500")
500 - 1,000	14	=COUNTIF(D2:D252,"500 - 1,000")
1,000 - 5,000	54	=COUNTIF(D2:D252,"1,000 - 5,000")
5,000 - 10,000	26	=COUNTIF(D2:D252,"5,000 - 10,000")
10,000 - 50,000	35	=COUNTIF(D2:D252,"10,000 - 50,000")
50,000 - 100,000	20	=COUNTIF(D2:D252,"50,000 - 100,000")
100,000 - 500,000	22	=COUNTIF(D2:D252,"100,000 - 500,000")
500,000 - 1,000,000	7	=COUNTIF(D2:D252,"500,000 - 1,000,000")
1,000,000 - 5,000,000	4	=COUNTIF(D2:D252,"1,000,000 - 5,000,000")
5,000,000 - 10,000,000	1	=COUNTIF(D2:D252,"5,000,000 - 10,000,000")
10,000,000 - 50,000,000	1	=COUNTIF(D2:D252,"10,000,000 - 50,000,000")
<b>Total Number of Apps</b>	<b>250</b>	<b>=SUM(H8:H22)</b>

### “Diet”

Google Play App Download Ranges	Number of apps in each rang	Formula
1 - 5	0	=COUNTIF(D2:D252,"1 - 5")
5 - 10	0	=COUNTIF(D2:D252,"5 - 10")
10 - 50	2	=COUNTIF(D3:D252,"10 - 50")
50 - 100	4	=COUNTIF(D2:D252,"50 - 100")
100 - 500	20	=COUNTIF(D2:D252,"100 - 500")
500 - 1,000	12	=COUNTIF(D2:D252,"500 - 1,000")
1,000 - 5,000	63	=COUNTIF(D2:D252,"1,000 - 5,000")
5,000 - 10,000	29	=COUNTIF(D2:D252,"5,000 - 10,000")
10,000 - 50,000	68	=COUNTIF(D2:D252,"10,000 - 50,000")
50,000 - 100,000	20	=COUNTIF(D2:D252,"50,000 - 100,000")
100,000 - 500,000	24	=COUNTIF(D2:D252,"100,000 - 500,000")
500,000 - 1,000,000	2	=COUNTIF(D2:D252,"500,000 - 1,000,000")
1,000,000 - 5,000,000	5	=COUNTIF(D2:D252,"1,000,000 - 5,000,000")
5,000,000 - 10,000,000	0	=COUNTIF(D2:D252,"5,000,000 - 10,000,000")
10,000,000 - 50,000,000	1	=COUNTIF(D2:D252,"10,000,000 - 50,000,000")
<b>Total Number of Apps</b>	<b>250</b>	<b>=SUM(H8:H22)</b>



## Appendix 6

The top popular 35 apps resulted from the search term “weight loss”

	100,000 - 500,000			
1	3	Effective Weight Loss Guide	naveeninfotech	100,000 - 500,000
2	15	43 Best Foods for Weight Loss	Insplisity	100,000 - 500,000
3	16	Weight Loss Diet Plan	Health Club	100,000 - 500,000
4	18	101 Weight Loss Tips	Programmerworld	100,000 - 500,000
5	22	Weight Loss Tracker	Matthew Wood	100,000 - 500,000
6	25	Fitocracy Workout Fitness Log	Fitocracy, Inc	100,000 - 500,000
7	29	Simple Weight Loss Resolution	Simple Health Apps	100,000 - 500,000
8	31	Easy Weight Loss	GLOBUS	100,000 - 500,000
9	32	Yoga for Weight Loss I (PRO)	DailyYoga Inc	100,000 - 500,000
10	39	Valentine's Weight Loss	Noom Inc.	100,000 - 500,000
11	40	Weight Loss & Healthy Foods	ZaleBox	100,000 - 500,000
12	48	10 Best Weight Loss Diet Plans	Insplisity	100,000 - 500,000
13	53	Yoga for Weight Loss II (PRO)	DailyYoga Inc.	100,000 - 500,000
14	80	Weight control	PanSoft	100,000 - 500,000
15	84	Weight War	Clevapps	100,000 - 500,000
16	86	Weight Diary	DSD	100,000 - 500,000
17	142	Ideal weight	MobilPlug	100,000 - 500,000
18	153	Weight Tracker	3qubits	100,000 - 500,000
19	202	How to lose weight	Reliablesoft.Net	100,000 - 500,000
20	213	How To Lose Weight Fast	Venture Technology Ltd	100,000 - 500,000
21	229	Weight Track Assistant	Kevin Tung	100,000 - 500,000
22	238	How To Lose Weight Quickly	Venture Technology Ltd	100,000 - 500,000
	500,000 - 1,000,000			
23	5	Monitor Your Weight	Husain Al-Bustan	500,000 - 1,000,000
24	6	Nexercise = fun weight loss	Nexercise	500,000 - 1,000,000
25	8	Weight Loss Tracker - RecStyle	Recruit Holdings Co.,Ltd.	500,000 - 1,000,000
26	26	BMI Calculator - Weight Loss	Przemysław Słota	500,000 - 1,000,000
27	85	Simple Weight Recorder	Beyonj	500,000 - 1,000,000
28	108	Diets for losing weight	STR LABS	500,000 - 1,000,000
29	160	DietCalendar Free(weight)	GalleryApp	500,000 - 1,000,000
	1,000,000 - 5,000,000			
30	1	Diet Assistant - Weight Loss	Alportela Labs -	1,000,000 - 5,000,000
31	2	My Diet Coach - Weight Loss	InspiredApps (A.L) LTD	1,000,000 - 5,000,000
32	10	Diet Point · Weight Loss	DietPoint Ltd.	1,000,000 - 5,000,000
33	14	Weight Tracker weight loss app	cryofy.com	1,000,000 - 5,000,000
	5,000,000 - 10,000,000			
34	9	BMI Calculator -Weight Loss	smayer.net	5,000,000 - 10,000,000
	10,000,000 - 50,000,000			
35	4	Noom Weight Loss Coach	Noom Inc.	10,000,000 - 50,000,000

## Appendix 7

	100,000 - 500,000			
1	6	The 90 Day Diet	Susanne Kessler	100,000 - 500,000
2	8	Diet Plan	AB Mobile Apps	100,000 - 500,000
3	14	Diet Diary ( Diet Calendar )	EONSOFT	100,000 - 500,000
4	16	Weight Loss Diet Plan	Health Club	100,000 - 500,000
5	19	Atkins Carb Tracker	Atkins Nutritionals	100,000 - 500,000
6	21	Calorie Counter PRO MyNetDiary	MyNetDiary.com	100,000 - 500,000
7	24	Photo diet	SukutaSystem	100,000 - 500,000
8	29	Paleo Diets & Recipes	ProsperTrack	100,000 - 500,000
9	30	Diet Pedometer	ACONTECH	100,000 - 500,000
10	45	South Beach Diet	Everyday Health	100,000 - 500,000
11	46	Pedometer Walking Diet	VALSIOR Co., Ltd.	100,000 - 500,000
12	47	M-Diet Helper	Nister Co.,Ltd.	100,000 - 500,000
13	50	my Diet Journal	Harvey G. Payne	100,000 - 500,000
14	53	Diet Camera	CONNIE	100,000 - 500,000
15	59	Diet Watcher Cookbook	Webcipe	100,000 - 500,000
16	60	100 days Diet	apple	100,000 - 500,000
17	61	Chien Binh Diet Quy	SNIPER SHOOTING	100,000 - 500,000
18	68	DietShin-diet 청혈주스 레시피	Diet&Calorie	100,000 - 500,000
19	69	3 Day Easy Diet app	App2Shop	100,000 - 500,000
20	72	Manage your weight and diet	KrAndroid	100,000 - 500,000
21	96	10 Best Weight Loss Diet Plans	Insplisity	100,000 - 500,000
22	108	Point by Point - Diet Lite	AIMTecnologia	100,000 - 500,000
23	136	4F Diet Exercises & Fitness	4Fitting	100,000 - 500,000
24	227	Calorie Counter & Diet Tracker	SparkPeople	100,000 - 500,000
	500,000 - 1,000,000			
25	17	Diets for losing weight	STR LABS	500,000 - 1,000,000
26	23	OneStep Diet	NHK ENTERPRISES, INC.	500,000 - 1,000,000
	1,000,000 - 5,000,000			
27	1	My Diet Coach - Weight Loss	InspiredApps (A.L) LTD	1,000,000 - 5,000,000
28	2	Diet Assistant - Weight Loss	Alportela Labs	1,000,000 - 5,000,000
29	3	My Diet Diary Calorie Counter	MedHelp, Inc - Top Health Apps	1,000,000 - 5,000,000
30	5	Diet Point · Weight Loss	DietPoint Ltd.	1,000,000 - 5,000,000
31	12	Woman's DIARY period · diet · cal	HighLab Co.,Ltd.	1,000,000 - 5,000,000
	5,000,000 - 10,000,000			
	None			
	10,000,000 - 50,000,000			
32	4	Calorie Counter - MyFitnessPal	MyFitnessPal, Inc.	10,000,000 - 50,000,000

The top popular 32 apps resulted from the search term “diet”

## Appendix 8

Appendix 8 demonstrates the worksheet that has used in evaluating iTunes apps.

App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Abstract and reflective	Public	Aesthetic	Controllable	Trending/Historical	Comprehensive	Index Score
1. My Diet Coach- Weight Loss for Women (© 2012 InspiredApps)		X	X	X				X	X			5
2. Jillian Michaels Slim-Down: Weight Loss, Diet, & Exercise Solution (©2013 everyday Health Inc.)			X	X	X				X			4
3. Walk with Map My Walk- GPS Walking, Jogging, Running, Workout Tracking for Diet Weight Loss (© 2013, MapMyFitness, Inc.)	X	X		X	X	X			X	X	X	8
4. Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... (©Surf City Apps LLC)		X										1
5. Weight Loss Hypnosis by Mindifi- Lose Fat with Better Health and Meditation (©Mindifi)												0
6. Calorie Counter & Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)	X	X		X	X	X	X		X	X		8
7. Nutricise-Meal Planner & Weight Loss Programs (©2013 Nutricise Pty Ltd)	X		X	X	X	X			X			6
8. Nexercise- motivation to lose weight, to finally meet your weight loss & health goals (© 2014 Nexercise Inc.)	X	X			X	X				X		5
9. TactioHealth (Weight Loss, Fitness, Hypertension & Diabetes Family eHealth Tracking System) (©2011-2014 Tactio Health Group Inc.)	X	X		X	X	X	X		X	X		8
10. Happy Scale: Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log... (© Front Pocket Software LLC)	X			X		X	X		X			5
11. Walkmeter GPS Pedometer- Walking Running Hiking for weight Loss Walk Tracker (©2014 Abvio Inc.)					X			X	X		X	4
12. Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss (©2012-2013 Clear Sky Apps Ltd)		X			X							2
13. Low Fat Recipes- Diet, Lose Fat, Lose Weight (© AC)			X									1
14. Australian Calorie Counter- Easy Diet Diary (© 2013 Xyris Holdings Pty Ltd)	X			X	X	X			X	X		6
15. MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health (© LIVESTRONG.COM)	X	X		X	X	X			X	X		7
16. My Diet Diary- Your Personal Calorie		X	X	X	X				X			5

<b>Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking (© 2012-2014 MedHelp)</b>												
<b>17. Calorie Counter and Diet Tracker by Calorie Count (© 2012 About, Inc.)</b>	X	X	X	X	X	X			X			7
<b>18. I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet (© 2013 I feel Good Pty Ltd)</b>			X									1
<b>19. Belly Fat Workout Free-10 Minute Ab Exercises (©procodemedia.com 2012)</b>		X			X							2
<b>20. Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter (© 2014 MapMyFitness Inc)</b>		X	X		X				X		X	5
<b>21. CalorieKing Australia Food Search (© CalorieKing Wellness Solutions, Inc.)</b>			X									1
<b>22. Nutrition Quiz: 600+Facts, Myths &amp; Diet Tips for Healthy Living (©2013 runtastic GmbH)</b>		X	X									2
<b>23. Fitbit (© 2014 Fitbit, Inc.)</b>	X	X		X	X	X			X	X	X	8
<b>24. Ab Trainer X Free- Six- Pack Abs Exercises &amp; Workouts (© procodemedia.com 2012)</b>					X							1
<b>25. Best Diet Foods- how to keep fit with diet (© zky)</b>		X	X					X				3

## Appendix 9

Appendix 9 presents the memos of each iPhone app that taken during the evaluation process.

App Name and its features	Date of Examining App	Duration of Examining App <sup>2</sup>	Comments
<b>1. My Diet Coach- Weight Loss for Women (© 2012 InspiredApps)</b> 1. <b>Monitoring User Data (Weight):</b> it did not track user weight. Just allow entering the goal weight without entering the start date. 2. <b>Availability of Social Support:</b> it allowed sharing tips with other users or friends. Also it connected to Facebook. 3. <b>Availability of Knowledge Resource:</b> it provided tips related to foods. So, the researcher considered that could increase user knowledge. 4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal. 5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity. 6. <b>Abstract and reflective:</b> it did not provide data in reflective way. 7. <b>Public:</b> it did not include login features. 8. <b>Aesthetic:</b> it allowed customising or adapting some features in app according to users personnel aesthetic preferences. 9. <b>Controllable:</b> it allowed user to manage data and control access to it. 10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends. 11. <b>Comprehensive:</b> it allowed user entering data but it did not take sensory data. Thus, it is not comprehensive.	22 July 2014	30:00:00	
<b>2. Jillian Michaels Slim-Down: Weight Loss, Diet, &amp; Exercise Solution (©2013 everyday Health Inc.)</b> 1. <b>Monitoring User Data (Weight):</b> it tracked user weight. 2. <b>Availability of Social Support:</b> it did not include. 3. <b>Availability of Knowledge Resource:</b> it provided a section included some nutrition tips. 4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal. 5. <b>Regular Physical Activity:</b> it recommended exercising for each day. 6. <b>Abstract and reflective:</b> it did not provide data in reflective way. 7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure. 8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences. 9. <b>Controllable:</b> it allowed user to enter and manage data. 10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends. 11. <b>Comprehensive:</b> it did not collect sensory data in this free version. It just manual data by users.	22 July 2014	1:10:00	
<b>3. Walk with Map My Walk- GPS Walking, Jogging, Running,</b>	22 July 2014	56:00:00	

<sup>2</sup> Start after downloading app. Start when first begins examining app.

<p><b><u>Workout Tracking for Diet Weight Loss (© 2013, MapMyFitness, Inc.)</u></b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it allowed track user start and end weight.</li> <li>2. <b>Availability of Social Support:</b> it allowed to add friends from twitter, Facebook, and contacts to support.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not include.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal and recommend certain amount of weight loss each week.</li> <li>5. <b>Regular Physical Activity:</b> it recommended a certain amount of physical activity.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph to allow users see their progress in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences</li> <li>9. <b>Controllable:</b> it allowed user to enter and manage data.</li> <li>10. <b>Trending / Historical:</b> it allowed users to see historical data per week.</li> <li>11. <b>Comprehensive:</b> it allowed to collect sensor data and it allowed user to enter and mange data.</li> </ol>			
<p><b><u>4. Weight Loss Hypnosis- Free Eat the Best Food, Lose Belly Fat Fast... (©Surf City Apps LLC)</u></b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>12. <b>Availability of Social Support:</b> it allowed to get friends support from twitter, Facebook, and contacts to support.</li> <li>2. <b>Availability of Knowledge</b></li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences</li> <li>9. <b>Controllable:</b> it did not allow user to enter or edit data.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. or manual data by users.</li> </ol>	22 July 2014	30:00:00	This app only allowed user to hear some audios to help in weight loss.
<p><b><u>5. Weight Loss Hypnosis by Mindifi- Lose Fat with Better Health and Meditation (©Mindifi)</u></b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target</li> </ol>	22 July 2014	25:00:00	This app only allowed user to hear some audios to help in weight loss. A pit similar to Weight Loss Hypnosis- Free Eat the Best



<p>weight</p> <ol style="list-style-type: none"> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences</li> <li>9. <b>Controllable:</b> it did not allow user to enter or edit data.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. or manual data by users.</li> </ol>			Food, Lose Belly Fat Fast... (©Surf City Apps LLC)
<p><b>6. Calorie Counter &amp; Diet Tracker by MyFitnessPal (©2009-2014 MyFitnessPal Inc.)</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking weight named track my (weight, neck, waist, or hips).</li> <li>2. <b>Availability of Social Support:</b> it advised users and allowed them to contact with other people in the network and that they use the same app.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide any place in the app to increase nutrition information/knowledge.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal</li> <li>5. <b>Regular Physical Activity:</b> it provided several recommendations for physical activity required to burn calories.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li>7. <b>Public:</b> it provided user the option of entering the password to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical (weekly, and monthly) data to allowing show changes and trends. Each has a graph.</li> <li>11. <b>Comprehensive:</b> it did not collect any sensory data by itself. It required downloading another app for collect sensor data (steps).</li> </ol>	23 July 2014	22:00:00	
<p><b>7. Nutricise-Meal Planner &amp; Weight Loss Programs (©2013 Nutricise Pty Ltd)</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking start and end weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include.</li> <li>3. <b>Availability of Knowledge Resource:</b> it provided several nutrition information.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal.</li> <li>5. <b>Regular Physical Activity:</b> it provided several recommendations for physical activity required to burn calories.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph allow user to</li> </ol>	23 July 2014	30:00:00	

<p>reflect their start and end weight.</p> <ol style="list-style-type: none"> <li>7. <b>Public:</b> it provided user the option of entering the password to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical (weekly, and monthly) data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect any sensory data by itself. It required downloading another app for collect sensor data (steps).</li> </ol>			
<p><b>8. Nexercise- motivation to lose weight, to finally meet your weight loss &amp; health goals (© 2014 Nexercise Inc.)</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provides an area of tracking weight.</li> <li>2. <b>Availability of Social Support:</b> it allowed chatting with other users or friends.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it did not give certain recommendation for weight loss or target goal.</li> <li>5. <b>Regular Physical Activity:</b> it tracked physical activity but it did not recommend a certain amount of physical activity for each week/day.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> the sensory data could not collected by this app.</li> </ol>	23 July 2014	25:00:00	
<p><b>9. TactioHealth (Weight Loss, Fitness, Hypertension &amp; Diabetes Family eHealth Tracking System) (©2011-2014 Tactio Health Group Inc.)</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking weight named weight</li> <li>2. <b>Availability of Social Support:</b> it allowed providing support to users via emailing the company.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter certain weight loss or target goal.</li> <li>5. <b>Regular Physical Activity:</b> It recommended a certain amount of physical activity.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress.</li> <li>7. <b>Public:</b> it provided passcodes to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic</li> </ol>	23 July 2014	32:00:00	



<p>preferences.</p> <p>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> the sensory data could not collected by this app.</p>			
<p><b>10. Happy Scale:Simple Weight Loss Tracker, Moving Average Tracking Graph, Daily Smooth Goal Watcher's Progress Monitor, Hacker's Diet Log...(© Front Pocket Software LLC)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking weigh.</p> <p>2. <b>Availability of Social Support:</b> it did not include.</p> <p>3. <b>Availability of Knowledge Resource:</b></p> <p>4. <b>Weight Loss Goal:</b> it allowed user to enter certain weight loss or target goal.</p> <p>5. <b>Regular Physical Activity:</b> it did recommend a certain amount of regular activities.</p> <p>6. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress.</p> <p>7. <b>Public:</b> it provided user the option of entering the password to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not.</p> <p>9. <b>Controllable:</b> it allowed user to edit and manage data.</p> <p>10. <b>Trending / Historical:</b> it did not reflect historical data in clear.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data.</p>	23 July 2014	25:00:00	
<p><b>11.Walkmeter GPS Pedometer- Wlaking Running Hiking for weight Loss Wlak Tracker (©2014 Abvio Inc.)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it did not provide an area of tracking weigh.</p> <p>2. <b>Availability of Social Support:</b> it did not include it in this version.</p> <p>3. <b>Availability of Knowledge Resource:</b> it did not include section for nutrition information.</p> <p>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goal or allowed user to enter it.</p> <p>5. <b>Regular Physical Activity:</b> it recommended a certain amount of regular activities.</p> <p>6. <b>Abstract and reflective:</b> it did not provide a graph that easily reflects user progress.</p> <p>7. <b>Public:</b> it did not provide user the option of entering the password to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow user to control some of the personal aesthetic preferences.</p> <p>9. <b>Controllable:</b> it allowed user to edit and manage data.</p> <p>10. <b>Trending / Historical:</b> it did not reflect historical data in clear.</p> <p>11. <b>Comprehensive:</b> it collected sensory data (GPS) and manual data and thus considered comprehensive.</p>	24 July 2014	45:00:00	
<p><b>12.Situps 0 to 200: sit ups Workout Trainer, Abs exercise free to help weight loss (©2012-2013 Clear Sky Apps Ltd)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it did not provide an area of tracking weigh.</p> <p>2. <b>Availability of Social Support:</b> it included it.</p> <p>3. <b>Availability of Knowledge Resource:</b> it did not include section for nutrition information.</p> <p>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goal or allowed user to enter it.</p>	24 July 2014	25:00:00	Great app for workout.

<ul style="list-style-type: none"> <li>5. <b>Regular Physical Activity:</b> it recommended many regular physical activities.</li> <li>6. <b>Abstract and reflective:</b> it did not provide a graph that easily reflects user progress.</li> <li>7. <b>Public:</b> it did not provide user the option of entering the password to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow user to control some of the personal aesthetic preferences.</li> <li>9. <b>Controllable:</b> it did not allow user to edit and manage data.</li> <li>10. <b>Trending / Historical:</b> it did not reflect historical data in clear.</li> <li>11. <b>Comprehensive:</b> it did not collect any data.</li> </ul>			
<p><b>13.Low Fat Recipes- Diet, Lose Fat, Lose Weight (© AC)</b></p> <ul style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not provide an area of tracking weigh.</li> <li>2. <b>Availability of Social Support:</b> it did not include it.</li> <li>3. <b>Availability of Knowledge Resource:</b> it included several recipes that can increase users nutrition information.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goal or allowed user to enter it.</li> <li>5. <b>Regular Physical Activity:</b> it did not recommended physical activities.</li> <li>6. <b>Abstract and reflective:</b> it did not provide a graph that easily reflects user progress.</li> <li>7. <b>Public:</b> it did not provide user the option of entering the password to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow user to control some of the personal aesthetic preferences.</li> <li>9. <b>Controllable:</b> it did not allow user to edit and manage data.</li> <li>10. <b>Trending / Historical:</b> it did not reflect historical data in clear.</li> </ul>	24 July 2014	15:00:00	This app merely provided several low fat recipes.
<p><b>14. Australian Calorie Counter- Easy Diet Diary (© 2013 Xyris Holdings Pty Ltd)</b></p> <ul style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it tracked user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a section included some nutrition tips.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal.</li> <li>5. <b>Regular Physical Activity:</b> it recommended exercising for each day.</li> <li>6. <b>Abstract and reflective:</b> it provided data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to enter and manage data.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data in this free version. It just manual data by users.</li> </ul>	24 July 2014	30:00:00	
<p><b>15.MyPlate Calorie Tracker LITE- Your Diet and Fitness Calorie Counter for Better Health (© IIVESTRONG. COM)</b></p> <ul style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it tracked user weight.</li> <li>2. <b>Availability of Social Support:</b> it included a section called community allow user to get support from others.</li> </ul>	24 July 2014	33:00:00	

<p>3. <b>Availability of Knowledge Resource:</b> it did not provide a section included some nutrition tips.</p> <p>4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal.</p> <p>5. <b>Regular Physical Activity:</b> it recommended regular exercising.</p> <p>6. <b>Abstract and reflective:</b> it provided data in reflective way.</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>9. <b>Controllable:</b> it allowed user to enter and manage data.</p> <p>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data in this free version. It just manual data by users.</p>			
<p><b>16. My Diet Diary- Your Personal Calorie Counter, Weight Log, Exercise and Fitness Tracker, Food and Nutrition Journal for Calorie Watchers Seeking (© 2012-2014 MedHelp)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it track calories remaining and consumed but not start and end weight.</p> <p>2. <b>Availability of Social Support:</b> it provided several forums to contact and get support from others (My forums, all medical support communities, and ask a doctor forums).</p> <p>3. <b>Availability of Knowledge Resource:</b> it provided nutrition information.</p> <p>4. <b>Weight Loss Goal:</b> it allowed user to enter desired goal weight.</p> <p>5. <b>Regular Physical Activity:</b> it recommended a physical activity for burning calories.</p> <p>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>9. <b>Controllable:</b> it allowed user to enter and edit some data.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data. It just allowed entering manual data by users.</p>	25 July 2014	35:00:00	This app is the same “My Diet Diary Calorie Counter” app that resulted from the Androide.
<p><b>17. Calorie Counter and Diet Tracker by Calorie Count (© 2012 About, Inc.)</b></p> <p><b>Trending / Historical:</b> it did not reflect historical data in clear.</p>	25 July 2014		
<p><b>18. I Feel Good Vegan Recipes and Meal Plans: Helping you make the transition to a Healthy Whole Food Plant Based Diet (© 2013 I feel Good Pty Ltd)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</p> <p>2. <b>Availability of Social Support:</b> it did not include.</p> <p>3. <b>Availability of Knowledge Resource:</b> it provided nutrition information.</p> <p>4. <b>Weight Loss Goal:</b> it did not allow user to enter desired goal weight.</p> <p>5. <b>Regular Physical Activity:</b> it did not recommend a</p>	25 July 2014	25:00:00	

<p>physical activity for burning calories.</p> <ol style="list-style-type: none"> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it did not allow user to enter and edit some data.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. It just allowed entering manual data by users.</li> </ol>			
<p><b>19. Belly Fat Workout Free-10 Minute Ab Exercises</b> (©procodemedia.com 2012)</p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it allowed users to seek support from the app company.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide nutrition information.</li> <li>4. <b>Weight Loss Goal:</b> it did not allow user to enter desired goal weight.</li> <li>5. <b>Regular Physical Activity:</b> it recommended a physical activity for burning calories.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it did not allow user to enter and edit some data.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. It just allowed entering manual data by users.</li> </ol>	25 July 2014	33:00:00	
<p><b>20. Run with Map My Run-GPS Running, Jog, Walk, Workout Tracking and Calorie Counter (© 2014 MapMyFitness Inc)</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it just tracked calories and not weight.</li> <li>2. <b>Availability of Social Support:</b> it allowed users to contact with and get support from their friends in Twitter, Facebook and mobile contacts.</li> <li>3. <b>Availability of Knowledge Resource:</b> it provided nutrition information in section named “Log Food”.</li> <li>4. <b>Weight Loss Goal:</b> it did not allow user to enter desired goal weight.</li> <li>5. <b>Regular Physical Activity:</b> it suggested regular physical activity for user. It included section called “activity feed”.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic</li> </ol>	29 July 2014	35:00:00	

<p>preferences.</p> <p>9. <b>Controllable:</b> it allowed users to edit and enter data.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it collected sensory data and allowed user to edit and enter data manually.</p>			
<p><b>21. CalorieKing Australia Food Search (© CalorieKing Wellness Solutions, Inc.)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</p> <p>2. <b>Availability of Social Support:</b> it did not allow users to get supports from others using the same app.</p> <p>3. <b>Availability of Knowledge Resource:</b> it provided three sections named “ food categories”, ”food brands”, and “ fast food chains” to increase user’s nutrition knowledge.</p> <p>4. <b>Weight Loss Goal:</b> it did not allow user to enter desired goal weight.</p> <p>5. <b>Regular Physical Activity:</b> it did not include.</p> <p>6. <b>Abstract and reflective:</b> it did not provide weight data in reflective way.</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>9. <b>Controllable:</b> it did not include.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data. It just allowed entering manual data by users.</p>	29 July 2014	20:00:00	This app only provided calories of several food items for different brands, resturants.
<p><b>22. Nutrition Quiz: 600+Facts, Myths &amp; Diet Tips for Healthy Living (©2013 runtastic GmbH)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it did not provide an area of tracking weigh in this version.</p> <p>2. <b>Availability of Social Support:</b> it allowed to do the nutrition quiz and compete with others users using the same app.</p> <p>3. <b>Availability of Knowledge Resource:</b> it provided nutrition information.</p> <p>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</p> <p>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity</p> <p>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences</p> <p>9. <b>Controllable:</b> it did not allow user to enter or manage data.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data or allowed user to enter data.</p>		40:00:00	
<p><b>23. Fitbit (© 2014 Fitbit, Inc.)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it tracked user weight.</p> <p>2. <b>Availability of Social Support:</b> it allowed getting support</p>		44:00:00	

<p>from user's contacts and friends.</p> <ol style="list-style-type: none"> <li>3. <b>Availability of Knowledge Resource:</b> it did not include nutrition knowledge resource.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter desired weight loss goal.</li> <li>5. <b>Regular Physical Activity:</b> it included recommendation for exercising.</li> <li>6. <b>Abstract and reflective:</b> it allowed users to see weight data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences</li> <li>9. <b>Controllable:</b> it allowed user to enter or manage data.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical (weekly, monthly, yearly) data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it collected sensory data and allowed user to enter data.</li> </ol>			
<p><b>24. Ab Trainer X Free- Six- Pack Abs Exercises &amp; Workouts</b> (© procodemedia.com 2012)</p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it did not allow user.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data or manually data by users.</li> </ol>		35:00:00	This app merely included training workout.
<p><b>25. Best Diet Foods- how to keep fit with diet (© zky)</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include</li> <li>3. <b>Availability of Knowledge Resource:</b> it included it.</li> <li>4. <b>Weight Loss Goal:</b> it did not provide a knowledge resource related to nutrition</li> <li>5. <b>Regular Physical Activity:</b> : it did not provide a recommendation for regular physical activity</li> <li>6. <b>Abstract and reflective:</b> it allowed user to change font size, style.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic</li> </ol>		40:00:00	

<p>preferences</p> <p>9. <b>Controllable:</b> it did not include.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data or manual data by users.</p>			
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## Appendix 10

Appendix 10 demonstrates the worksheet that has used in evaluating Google Play apps.

App Name	Monitoring User Data (Weight)	Social Support	Knowledge Resource	Weight Loss Goal	Regular Physical Activity	Abstract and reflective	Public	Aesthetic	Controllable	Trending/Historical	Comprehensive	Index Score
1. Noom Weight Loss Coach	X	X	X	X	X	X			X	X		8
2. BMI Calculator -Weight Loss				X					X			2
3. Diet Assistant - Weight Loss	X	X		X		X			X	X		6
4. My Diet Coach - Weight Loss		X	X	X				X	X			5
5. Diet Point · Weight Loss	X	X		X					X			4
6. Monitor Your Weight	X			X		X	X		X	X		6
7. Nexercise = fun weight loss	X	X				X			X	X		5
8. Weight Loss Tracker - RecStyle	X	X		X		X		X				5
9. BMI Calculator - Weight Loss									X			1
10. Simple Weight Recorder				X		X			X	X		4
11. Diets for losing weight	X					X						2
12. Effective Weight Loss Guide			X		X				X			3
13. Valentine's Weight Loss												0
14. Weight Loss & Healthy Foods		X	X									2
15. Weight control	X			X		X		X	X	X		6
16. Weight War	X			X		X	X		X	X		6
17. Weight Diary	X			X		X	X		X	X		6
18. Weight Track Assistant	X			X		X	X		X	X		6
19. Calorie Counter - MyFitnessPal	X	X		X	X	X	X		X	X		8
20. My Diet Diary Calorie Counter		X	X	X	X				X			5
21. Diet Plan	X		X	X	X	X			X			6
22. Diet Diary (Diet Calendar)	X					X			X	X		4
23. Photo diet	X			X		X	X		X	X		6
24. Point by Point - Diet Lite				X					X	X		3
25. Calorie Counter & Diet Tracker	X	X	X	X	X	X	X	X	X			9
26. 10 Best Weight Loss Diet Plans			X									1



## Appendix 11

Appendix 11 presents the memos of each Android app that has taken during the evaluation process.

App Name and its features	Date of Examining App	Duration of Examining App <sup>3</sup>	Comments
<b>1. Noom Weight Loss Coach</b> <ol style="list-style-type: none"> <li><b>Monitoring User Data (Weight):</b> it provided an area of tracking weight named weight log.</li> <li><b>Availability of Social Support:</b> it allowed sharing with Facebook users and allowed email experts.</li> <li><b>Availability of Knowledge Resource:</b> There is a knowledge resource area (articles related to nutrition).</li> <li><b>Weight Loss Goal:</b> it provided target weight.</li> <li><b>Regular Physical Activity:</b> it provided recommendation of 2000 steps daily for user and provided a mean to collect these 2000 steps.</li> <li><b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li><b>Public:</b> it did not provide login or password.</li> <li><b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li><b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends. Named history.</li> <li><b>Comprehensive:</b> it allowed user to enter data and collected sensory data but it did not allow user to edit sensory data. Thus, it is not comprehensive.</li> </ol>	14 July 2014	1:20:00	
<b>2. BMI Calculator -Weight Loss</b> <ol style="list-style-type: none"> <li><b>Monitoring User Data (Weight):</b> it did not monitor user start weight to end weight.</li> <li><b>Availability of Social Support:</b> it did not include it in any way.</li> <li><b>Availability of Knowledge Resource:</b></li> <li><b>Weight Loss Goal:</b> it provided ideal weight so it considered the target goal.</li> <li><b>Regular Physical Activity:</b> it did not provide recommendation for regular physical activity.</li> <li><b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li><b>Public:</b> it did not provide login or password.</li> <li><b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li><b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li><b>Comprehensive:</b> it did not collect sensory data.</li> </ol>	16 July 2014	45:00:00	
<b>3. Diet Assistant - Weight Loss</b>	17 July 2014	1:00:00	

<sup>3</sup> Start after downloading app. Start when first begins16 examining app.

<p><b>1. Monitoring User Data (Weight):</b> it provides an area of tracking weight named weight tracker.</p> <p><b>2. Availability of Social Support:</b> it provided a several discussion boards with other users who using apps in the network.</p> <p><b>3. Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</p> <p><b>4. Weight Loss Goal:</b> it allow user to enter weight loss goal.</p> <p><b>5. Regular Physical Activity:</b> it did not provide recommendation for regular physical activity.</p> <p><b>6. Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</p> <p><b>7. Public:</b> it did not include login features or passwords.</p> <p><b>8. Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p><b>9. Controllable:</b> it allowed user to manage data and control access to it.</p> <p><b>10. Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends.</p> <p><b>11. Comprehensive:</b> it allowed user enter data but it did not take sensory data. Thus, is not comprehensive.</p>			
<p><b>4. My Diet Coach - Weight Loss</b></p> <ol style="list-style-type: none"> <li><b>1. Monitoring User Data (Weight):</b> it did not track user weight. Just allow entering the goal weight without entering the start date.</li> <li><b>2. Availability of Social Support:</b> it allowed sharing tips with other users or friends. Also it connected to Facebook.</li> <li><b>3. Availability of Knowledge Resource:</b> it provided tips related to foods. So, the researcher considered that could increase user knowledge.</li> <li><b>4. Weight Loss Goal:</b> it allowed user to enter weight loss goal.</li> <li><b>5. Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li><b>6. Abstract and reflective:</b> it did not provide data in reflective way.</li> <li><b>7. Public:</b> it did not include login features.</li> <li><b>8. Aesthetic:</b> it allowed customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>9. Controllable:</b> it allowed user to manage data and control access to it.</li> <li><b>10. Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li><b>11. Comprehensive:</b> it allowed user entering data but it did not take sensory data. Thus, it is not comprehensive.</li> </ol>	17 July 2014	54:28:00	This app required network connectivity to work properly.
<p><b>5. Diet Point · Weight Loss</b></p> <ol style="list-style-type: none"> <li><b>1. Monitoring User Data (Weight):</b> it provided a self-tracking for start weight and end weight named weight tracker.</li> <li><b>2. Availability of Social Support:</b> it provided several forums to allow users discuses to each other.</li> <li><b>3. Availability of Knowledge Resource:</b> There is no knowledge resource area except the diet plans.</li> </ol>	17 July 2014	35:00:00	

<ol style="list-style-type: none"> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it allowed user entering data but it did not take sensory data. Thus, it is not comprehensive.</li> </ol>			
<p><b>6. Monitor Your Weight</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided a self-tracking for start weight and target weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter target weight or it calculated based on the user enter data.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight for every month from start date to the suggested end date.</li> <li>7. <b>Public:</b> it provided user the option of entering login password.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to enter target weight or it calculated based on the user enter data.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends. Named history.</li> <li>11. <b>Comprehensive:</b> it allowed user to enter data manually but it did not collect sensory data.</li> </ol>	17 July 2014	45:00:00	
<p><b>7. Nexercise = fun weight loss</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provides an area of tracking weight named weight</li> <li>2. <b>Availability of Social Support:</b> it allowed chatting with other users or friends.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it did not give certain recommendation for weight loss or target goal.</li> <li>5. <b>Regular Physical Activity:</b> it tracked physical activity but it did not recommend a certain amount of physical activity for each week/day.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress.</li> </ol>	17 July 2014	30:00:00	

<ul style="list-style-type: none"> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> the sensory data could not be collected by this app.</li> </ul>			
<b>8. Weight Loss Tracker - RecStyle</b> <ul style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide it.</li> <li>4. <b>Weight Loss Goal:</b> it provided a target weight on the graph.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity</li> <li>12. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>6. <b>Aesthetic:</b> it allowed user to change background colours.</li> <li>7. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>8. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>9. <b>Comprehensive:</b> it did not collect sensory data.</li> </ul>	17 July 2014	45:00:00	
<b>9. BMI Calculator - Weight Loss</b> <ul style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way.</li> <li>3. <b>Availability of Knowledge Resource:</b> not included.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</li> <li>5. <b>Regular Physical Activity:</b> not included. it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not provide sensory data. just manual data by users.</li> </ul>	18 July 2014	1:00:00	

<p><b>10. Simple Weight Recorder</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter target weight.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends. Named history.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. Just manual data by users.</li> </ol>	18 July 2014	1:00:00	
<p><b>11. Diets for losing weight</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it provided an area of tracking weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph that easily reflects user progress.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to enter weight however the function of calculating weight was incorrect and thus uncontrollable.</li> <li>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</li> </ol>	18 July 2014	35:00:00	This app provides the perfect weight wrong. The researcher knew it was wrong as it provided a very large number. E.g. 10353 kg.
<p><b>12. Effective Weight Loss Guide</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way.</li> <li>3. <b>Availability of Knowledge Resource:</b> it provided area for providing several foods, and weight loss tips.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain</li> </ol>	19 July 2014	20:00:00	

<p>weight loss goals for their users, or allow user to enter target weight.</p> <ol style="list-style-type: none"> <li><b>Regular Physical Activity:</b> it provided tips for regular physical activity. For example, "do 10 burpees every morning".</li> <li><b>Abstract and reflective:</b> it did not provide user entered data in reflective way.</li> <li><b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li><b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>Controllable:</b> it allowed user to enter some data and thus considered controllable.</li> <li><b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</li> <li><b>Comprehensive:</b> it did not collect sensory data. it just manual data by users.</li> </ol>			
<p><b>13. Valentine's Weight Loss</b></p> <ol style="list-style-type: none"> <li><b>Monitoring User Data (Weight):</b></li> <li><b>Availability of Social Support:</b></li> <li><b>Availability of Knowledge Resource:</b></li> <li><b>Weight Loss Goal:</b></li> <li><b>Regular Physical Activity:</b></li> <li><b>Abstract and reflective:</b></li> <li><b>Public:</b></li> <li><b>Aesthetic:</b></li> <li><b>Controllable:</b></li> <li><b>Trending / Historical:</b></li> <li><b>Comprehensive:</b></li> </ol>	19 July 2014	4:00:00	This app did not provide any of the desired functions of the framework elements. Instead it required to download another program named cardio trainer to start its function. "it does not do anything until cardio trainer is installed" Noom Inc. Thus, as this app did not provide any function without depending on other program, this app has took zero in its index score.
<p><b>14. Weight Loss &amp; Healthy Foods</b></p> <ol style="list-style-type: none"> <li><b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li><b>Availability of Social Support:</b> it did not include.</li> <li><b>Availability of Knowledge Resource:</b> it provided a lot of healthy food information.</li> <li><b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</li> <li><b>Regular Physical Activity:</b> it did not provide a clear recommendation for regular physical activity.</li> <li><b>Abstract and reflective:</b> it did not provide data in reflective way. No graphs or any virtual means.</li> <li><b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li><b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>Controllable:</b> it did not allow user to enter any type of data.</li> <li><b>Trending / Historical:</b> it did not enable users to</li> </ol>	19 July 2014	29:00:00	

<p>accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not allow user enters data and it did not collect sensory data. It just manual data by users.</p>			
<p><b>15. Weight control</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it took start weight and end weight to track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter weight loss goal.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it allowed customising or adapting app theme according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical data to allowing show changes and trends. Named history.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. It just allowed entering manual data by users.</li> </ol>	19 July 2014	35:00:00	
<p><b>16. Weight War:</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it took start weight and end weight to track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it.</li> <li>3. <b>Availability of Knowledge Resource:</b></li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter target weight.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity per day/week/month.</li> <li>6. <b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li>7. <b>Public:</b> it provided user the option of entering login password.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it enabled users to accessing historical (daily, weekly, monthly) data to allowing show changes and trends. Each has a graph.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</li> </ol>	19 July 2014	40:00:00	
<p><b>17. Weight Diary</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it took start weight and end weight to track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not provide.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not</li> </ol>	20 July 2014	50:00:00	



<p>provide.</p> <ol style="list-style-type: none"> <li><b>Weight Loss Goal:</b> it allowed user to enter target weight.</li> <li><b>Regular Physical Activity:</b> it did not provide any recommendation for physical activity.</li> <li><b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li><b>Public:</b> it provided user the option of entering login password.</li> <li><b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li><b>Trending / Historical:</b> it enabled users to accessing historical (weekly, monthly, yearly) data to allowing show changes and trends. Each has a graph.</li> <li><b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</li> </ol>			
<p><b>18. Weight Track Assistant</b></p> <ol style="list-style-type: none"> <li><b>Monitoring User Data (Weight):</b> it provided a mean to track user start and end weight.</li> <li><b>Availability of Social Support:</b> it did not provide any.</li> <li><b>Availability of Knowledge Resource:</b> it did not provide any.</li> <li><b>Weight Loss Goal:</b> it allowed user to enter target weight.</li> <li><b>Regular Physical Activity:</b> it did not provide any recommendation for physical activity.</li> <li><b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li><b>Public:</b> it provided user the option of drawing the password by touching to avoid unwanted disclosure.</li> <li><b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li><b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li><b>Trending / Historical:</b> it enabled users to accessing historical (weekly, monthly, yearly) data to allowing show changes and trends. Each has a graph.</li> <li><b>Comprehensive:</b> it did not collect any sensory data.</li> </ol>	20 July 2014	35:00:00	This app demonstrated the best “abstract and reflective” feature. Very nice calendar graphs, and other visual progress reflections.
<p><b>19. Calorie Counter - MyFitnessPal</b></p> <ol style="list-style-type: none"> <li><b>Monitoring User Data (Weight):</b> it provided an area of tracking weight named track my (weight, neck, waist, or hips).</li> <li><b>Availability of Social Support:</b> it advised users and allowed them to contact with other people in the network and that they use the same app.</li> <li><b>Availability of Knowledge Resource:</b> it did not provide any place in the app to increase nutrition information/knowledge.</li> <li><b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal</li> <li><b>Regular Physical Activity:</b> it provided several recommendations for physical activity required to burn calories.</li> <li><b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</li> <li><b>Public:</b> it provided user the option of entering the</li> </ol>	20 July 2014	30:00:00	



<p>password to avoid unwanted disclosure.</p> <p>19. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>20. <b>Controllable:</b> it allowed user to manage data and control access to it.</p> <p>21. <b>Trending / Historical:</b> it enabled users to accessing historical (weekly, and monthly) data to allowing show changes and trends. Each has a graph.</p> <p>22. <b>Comprehensive:</b> it did not collect any sensory data by itself. It required downloading another app for collect sensor data (steps).</p>			
<p><b>20. My Diet Diary Calorie Counter</b></p> <p>12. <b>Monitoring User Data (Weight):</b> it track calories remaining and consumed but not start and end weight.</p> <p>13. <b>Availability of Social Support:</b> it provided several forums to contact and get support from others (My forums, all medical support communities, and ask a doctor forums).</p> <p>14. <b>Availability of Knowledge Resource:</b> it provided nutrition information.</p> <p>15. <b>Weight Loss Goal:</b> it allowed user to enter desired goal weight.</p> <p>16. <b>Regular Physical Activity:</b> it recommended a physical activity for burning calories.</p> <p>17. <b>Abstract and reflective:</b> it did not provide data in reflective way.</p> <p>18. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>19. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>20. <b>Controllable:</b> it allowed user to enter and edit some data.</p> <p>21. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>22. <b>Comprehensive:</b> it did not collect sensory data. It just allowed entering manual data by users.</p>	20 July 2014	45:00:00	
<p><b>21. Diet Plan</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it allowed track start weight and end weight..</p> <p>2. <b>Availability of Social Support:</b> it did not allow user to contact with other people using the same app.</p> <p>3. <b>Availability of Knowledge Resource:</b> it offered user a section to increase nutrition information.</p> <p>4. <b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal</p> <p>5. <b>Regular Physical Activity:</b> it recommend user to enter a certain amount of physical activity for each day. Also, it allowed user to training by trainer for 10, 30, or 60 minutes each day.</p> <p>6. <b>Abstract and reflective:</b> it provided data in reflective way (Graph).</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>9. <b>Controllable:</b> it allowed user to manage data and</p>	20 July 2014	30:00:00	This app required network connectivity to work.

<p>control access to it.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>12. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</p>			
<p><b>22. Diet Diary (Diet Calendar)</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it allowed track user weight.</p> <p>2. <b>Availability of Social Support:</b> it did not include.</p> <p>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</p> <p>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</p> <p>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</p> <p>6. <b>Abstract and reflective:</b> it provided a graph allow user to reflect their start and end weight.</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>9. <b>Controllable:</b> it allowed user to enter data.</p> <p>10. <b>Trending / Historical:</b> it provided a calendar with the weight demonstrated in each day of each month.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users. It allow to download a pedometer app to allow sensory collect of steps.</p>	21 July 2014	40:00:00	
<p><b>23. Photo diet</b></p> <p>1. <b>Monitoring User Data (Weight):</b> it allowed user to enter start weight and goal weight to track it.</p> <p>2. <b>Availability of Social Support:</b> it did not include.</p> <p>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</p> <p>4. <b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal.</p> <p>5. <b>Regular Physical Activity:</b> it did not recommend any amount of regular activity.</p> <p>6. <b>Abstract and reflective:</b> it allowed user to see weight data in reflective way (graph).</p> <p>7. <b>Public:</b> it allowed user to enter password to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</p> <p>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</p> <p>10. <b>Trending / Historical:</b> it provided an area to allow user to see weekly and monthly weight progress.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</p>	21 July 2014	40:00:00	
<b>24. Point by Point - Diet Lite</b>	21 July 2014	1:00:00	

<ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not allow to track weight in this version but only in the full version.</li> <li>2. <b>Availability of Social Support:</b> it did not include.</li> <li>3. <b>Availability of Knowledge Resource:</b> it did not provide a knowledge resource related to nutrition.</li> <li>4. <b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a recommendation for regular physical activity.</li> <li>6. <b>Abstract and reflective:</b> it did not allow user to see the weight data in reflective way.</li> <li>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</li> <li>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences.</li> <li>9. <b>Controllable:</b> it allowed user to manage data and control access to it.</li> <li>10. <b>Trending / Historical:</b> it provided an area to allow user to see weekly and monthly weight progress.</li> <li>11. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</li> </ol>			
<p><b>25. Calorie Counter &amp; Diet Tracker</b></p> <ol style="list-style-type: none"> <li>13. <b>Monitoring User Data (Weight):</b> it allowed track user start and end weight.</li> <li>14. <b>Availability of Social Support:</b> it provided a section called friend feed for friends support.</li> <li>15. <b>Availability of Knowledge Resource:</b> it provided section for the nutrition information.</li> <li>16. <b>Weight Loss Goal:</b> it allowed user to enter the weekly weight loss goal and recommend certain amount of weight loss each week.</li> <li>17. <b>Regular Physical Activity:</b> it recommended 180 minutes of exercising for each week.</li> <li>18. <b>Abstract and reflective:</b> it allowed user to see weight data in reflective way (graph).</li> <li>19. <b>Public:</b> it allowed user to enter login and enter password.</li> <li>20. <b>Aesthetic:</b> it allowed customize the screen of app according to user aesthetic preferences.</li> <li>21. <b>Controllable:</b> it allowed user to enter and manage data.</li> <li>22. <b>Trending / Historical:</b> it did not give historical data in clear.</li> <li>23. <b>Comprehensive:</b> it did not collect sensory data. It just manual data by users.</li> </ol>	21 July 2014	1:00:00	
<p><b>26. 10 Best Weight Loss Diet Plans</b></p> <ol style="list-style-type: none"> <li>1. <b>Monitoring User Data (Weight):</b> it did not track user weight.</li> <li>2. <b>Availability of Social Support:</b> it did not include it in any way. Apps that just allowed user to send the link of the app to others in the networks did not consider as it provided a social support for their users.</li> <li>3. <b>Availability of Knowledge Resource:</b> it could increase user knowledge of nutrition information as it included several diet plans.</li> <li>4. <b>Weight Loss Goal:</b> it did not recommend certain weight loss goals for their users, or allow user to enter target weight.</li> <li>5. <b>Regular Physical Activity:</b> it did not provide a</li> </ol>	21 July 2014	30:00:00	

<p>recommendation for regular physical activity</p> <p>6. <b>Abstract and reflective:</b> it did not provide data in reflective way.</p> <p>7. <b>Public:</b> it did not provide login or passwords to avoid unwanted disclosure.</p> <p>8. <b>Aesthetic:</b> it did not allow customising or adapting some features in app according to users personnel aesthetic preferences</p> <p>9. <b>Controllable:</b> it did not allow user to enter or manage data.</p> <p>10. <b>Trending / Historical:</b> it did not enable users to accessing historical data to allowing show changes and trends.</p> <p>11. <b>Comprehensive:</b> it did not collect sensory data or allowed user to enter data.</p>			
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## Appendix 12

Exemplar of Memos taking in the deductive thematic analysis for one of the Google Play apps:

### Memo 3- 26 Aug. 14

App 3- there was too many useless comments. So, they have excluded such as the following reviews: Suhail Shaikh August 26, 2014 "Normal", Suhana Bahari August 22, 2014 "Practical.n im satisfied". All such comments have excluded.

### Memo 4- 26 Aug. 14

App 4- it were too many comments about the reminders function although it is not one of the elements of the evaluation framework. **(So it may important to include the reminders features in the future weight loss and diet evaluation frameworks)**  
Also reminder seems to be considered a motivational feature.

### Memo 5- 27Aug. 14

App 5- Diet Point · Weight Loss:

There are too many reviews that said the reminder function of it is extremely good. Examples: Mila Milott June 1, 2014 "Great app ever □ it helps me to remind eat time!" and Asaf Biton June 1, 2014 "Great app, I really like being reminded to eat. PLEASE add an option to add my own diet plans!", A Google User May 31, 2014 "Extensive diets It gives you exact diet and an alarm to remind you what to eat when I really liked the app and am following it religiously", Tatia Shabazz May 29, 2014 "The reminder is great".

### Memo 6- 27 August 2014

App 6- Monitor Your Weight

This apps included many reviews said that it did exactly what it said by apps. For example, David Koontz August 9, 2014 "Perfect! Does exactly what it says plus, the graphs help too. Does even more than I need. Totally helps with motivation. :)". Thus users may like to obtain an app that does what it says.

### Memo 7- 28 August 2014

App 7- Nexercise= fun weight loss

This app includes some reviews that indicate that it is including exercises although the framework results did not mention that. For example, Felipe M. C. Conti July 25, 2014 "Stimulating! Very stimulating way of maintaining the exercising routine".

Also included several comments related to the rewarding:

E.g. Lora Seider August 21, 2014

"Fun place to meet new people to keep you motivated and to see your progress with your physical health with a fun award/reward system. Minor tracking glitches, GPS distance tracking off sometimes".

Also included several comments related to the Motivation:

E.g. Talia Davis August 7, 2014

*"So much motivation! Helps you cohnt the calories you burned. It is encouraging. It promotes healthy living. It is fun to compete with friends. It has the ability to know when youre moving and for how long. Incredibly motivating with points, medals and achievements. A whole lotta help for me. I have lost 40lbs and am still losing. Highly recommend this app for people who need that extra push to just keep going! You can do it. :)"*



## Appendix 13

**Customer Reviews**

[Write a Review](#) [App Support](#)

6 Customer Reviews [Most Helpful](#)

**Great app ★★★★★**  
by bazzingtonn – Aug 27, 2014  
Finally good work out apps! I work out and like to stay fit... This really works the abs and its great for all levels. I'm recommending it to all my friends.  
[Was this review helpful?](#) Yes | No | [Report a Concern](#)

**Yay ★★★★★**  
by teej\_7 – Sep 17, 2014  
Such a fantastic app it makes it easy to get your abs burning and easy to stick to because of the count down timer  
[Was this review helpful?](#) Yes | No | [Report a Concern](#)

**Good, except for all the ads ★★★★★☆**  
by DMFAN78 – Sep 1, 2014  
Even when you make an inapp purchase it's still bloated with ads. Besides that work out is pretty good  
[Was this review helpful?](#) Yes | No | [Report a Concern](#)

**Me now got abs ★★★★★**  
by Dartanien – Aug 14, 2014  
Wow this good  
[Was this review helpful?](#) Yes | No | [Report a Concern](#)

[Was this review helpful?](#) Yes | No | [Report a Concern](#)

**Nice easy exercises ★★★★★☆**  
by TezzaPerth – Sep 16, 2014  
Great for a beginner like me  
[Was this review helpful?](#) Yes | No | [Report a Concern](#)

**Awesome ★★★★★☆**  
by supasach – Jul 26, 2014  
Loving it!!!!  
[Was this review helpful?](#) Yes | No | [Report a Concern](#)

Stage Two- Initial Codes

App 24. Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)	Initial Codes
Great app iTunes User 1, Aug 27 2014	
	good work out apps
	works the abs and its great for all levels
	recommending it to all friends
Yay by iTunes User 2, Sep 17 2014	
	a fantastic app
	makes it easy to get abs burning
	easy to stick to as it includes timer
Good, except for all the ads by iTunes User 3, Sep 1 2014	
	bloated with ads
	work out pretty good
Me now got abs by iTunes User 4, Aug 14 2014	
	good app
Nice easy exercises by iTunes User 5, Sep 16 2014	
	great for beginner
Awesome by iTunes User 5, 26 2014	
	Loveing it!!!

Stage Three- Identifying Themes

App 24. Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)	Themes 1
good work out apps	Exercises
works the abs and its great for all levels	Exercises
recommending it to all friends	Recommended
a fantastic app	App Pros
makes it easy to get abs burning	Exercises
easy to stick to as it includes timer	Easy to use
bloated with ads	Annoying Ads
work out pretty good	Exercises
good app	App Pros
great for beginner	Easy to Use
Loveing it!!!	App Pros

Stage Four- Reviewing Themes

App 24. Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)	Themes 2
Exercises	Exercise Tracking
Exercises	Exercise Tracking
Recommended	Recommended
App Pros	App Pros
Exercises	Exercise Tracking
Easy to Stick	Easy of Use
Annoying Ads	Annoying Ads
Exercises	Exercise Tracking
App Pros	App Pros
Easy to Use	Ease of Use
App Pros	App Pros

Stage Five- Categorising Themes

App 24. Ab Trainer X Free- Six- Pack Abs Exercises & Workouts (© procodemedia.com 2012)	Categories
Exercises	Regular Physical Activity
Exercises	Regular Physical Activity
Recommended	<b>Recommended</b>
App Odds	<b>App Pros</b>
Exercises	Regular Physical Activity
Easy to Use	<b>Ease of Use</b>
Annoying Ads	<b>Annoying Ads</b>
Exercises	Regular Physical Activity
App Odds	<b>App Pros</b>
Easy to Use	<b>Ease of Use</b>
App Odds	<b>App Pros</b>